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OF
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VOLUME LXXII

1920

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THE ACADEMY OF NATURAL SCIENCES
1921

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PROCEEDINGS
OF THE
ACADEMY OF NATURAL SCIENCES
OF
PHILADELPHIA.

1920

January 20.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Seventy-two persons present.

The deaths of the following members were announced: Rebecca Gibson, Annabelle E. Richards, D. Murray Cheston, William Osler, Horatio C. Wood, and Edwin S. Dixon.

MR. JAMES A. G. REHN made a communication entitled: "The Work of the Hebard-Academy Expedition of 1919 in Nevada and California." (No abstract.)

The Council reported the appointment by the President of the following committees: ON POLICY—Messrs. E. G. Conklin, R. A. F. Penrose, Milton J. Greenman, J. Percy Moore, George Vaux, Jr., George E. de Schweinitz, Effingham B. Morris, and George L. Harrison, Jr. ON THE HAYDEN MEMORIAL AWARD—Messrs. R. A. F. Penrose, *Chairman*, Edgar T. Wherry, Charles D. Walcott, and John Mason Clark.

William W. Matos, J. E. B. Buckenham, David E. Harrower, Harry W. Trudell, Sabin W. Colton, Jr., Hamilton Bradshaw, Childs Frick, and Arthur R. Spencer were elected Members.

The following was ordered to be printed:

COSTA RICAN LAND AND FRESHWATER MOLLUSKS.

BY HENRY A. PILSBRY.

The mollusks enumerated below were collected by Dr. Philip P. Calvert and Mrs. (Amelia S.) Calvert in the year of their residence in Costa Rica, from May, 1909, to May, 1910.¹ As their chief object was to study life histories and transformations of tropical dragonflies, other material was taken only when encountered in the course of this pursuit.

Much of their field work was done in districts where Prof. Paul Biolley² and H. Pittier had collected shells, yet some eight species new to Costa Rica were found, five of them new to science. This large proportion, in a total of 28 species taken, is evidence that our knowledge of the fauna is still very incomplete, though as von Martens remarks, it is "one of the best known within Central America."

Biolley has carefully recorded the elevation of localities where he collected shells, and some additions to this subject are now made; but on tabulating the data it appears that so many species are known from few localities, or but one, that conclusions as to zonal distribution would be too crude to have value. Some species have a wide vertical range; the apparent restriction of others in the same districts may probably be due to deficient collecting.

Costa Rica is known as farthest north for a number of characteristically South American genera, such as *Labyrinthus*, *Solaropsis* and *Marisa*. The Brazilian genus *Uncancylus*, now reported, is an interesting addition to this series.

¹ Calvert, Amelia S. and Philip P. A Year of Costa Rican Natural History New York. The Macmillan Company, 1917. Besides details as to the localities where collecting was done, this interesting book contains a map and a bibliography of Costa Rican natural history, and related subjects.

² Biolley, P. Moluscos terrestres y fluviales de la meseta central de Costa Rica. San José. Tipografía Nacional, 1897. Fifty-nine species are listed, with localities and comments.

The material collected by Biolley and Pittier was determined and the new forms described by Professor E. von Martens in his fine volume on land and freshwater mollusks in the Biología Centrali-Americana, 1890-1901.

CYCLOPHORIDÆ.

Aperostoma dysoni (Pfr.)^{*}

Bonnefil Farm, Rio Surubres, 700 ft. Oct. 20, 1909.

HELICINIDÆ

Helicina funcki Angas.

Guapiles, 980 ft. Nov. 18, 1909.

Helicina deppeana parvidens n. subsp.

Juan Viñas, farther waterfall, 3300 ft.; also on the road to Rio Reventazón, 3000 ft. Type, No. 105286, A. N. S. P.

The shell resembles *H. deppeana* v. Martens, of eastern Mexico, except that there is only a very low, rather wide prominence at the junction of the columella and basal lip, with no appearance of a notch below it.

Alt. 10, diam. 13.3 mm.

OLEACINIDÆ.

Streptostyla viridula Angas.

Near Juan Viñas, on road to Rio Reventazón, between 2500 and 3000 ft. July 23, 1909.

ZONITIDÆ.

Guppya calverti n. sp. Fig. 1.

Stream near the railroad west of Juan Viñas, 3300 ft. Type No. 105266, A. N. S. P.

The shell is perforate, pyramidal, fragile, pale yellow. The apex is obtuse, outlines of the spire straight; periphery acutely keeled; base convex. The surface is smooth and glossy. The whorls are convex, the last very narrowly concave on both sides of the thin median keel, the concavity forming a narrow impressed margin above the last coil of the suture. The base is impressed around the narrow perforation. The aperture is rhombic, acutely angular at the termination of the peripheral keel. Columella is short, sub-vertical, the columellar margin reflexed in a triangular plate half covering the perforation.

Alt. 2.5, diam. 3 mm.; 5 whorls.

This species is very distinct by its acute peripheral keel. The only form of the region approaching it is the much larger *G. angasi* Tryon,³ which differs in proportions.

^{*} *Stenopus guildingi* Angas, Proc. Zool. Soc., 1879, p. 284, not of Bland, 1865. Renamed *Hyalinia* (*Stenopus*) *angasi* Tryon, Manual of Conchology (2) II, 1886, p. 182; and again, *Guppya angasi* v. Martens, Biologia Centrali-Americana, Moll., 1892, p. 120.

Guppya costaricana n. sp. Fig. 2.

Alajuela, 3200 ft. Type No. 105285, A. N. S. P.

The shell is minutely perforate, globosely conic, very fragile, light yellow; outlines of the spire are perceptibly concave, the periphery bluntly carinate. The surface is very glossy, marked with weak growth-wrinkles, and under the microscope a very fine, close, vertical striation and minute spiral lines almost equally close are seen on the second to fourth whorls, very weak on the fourth. The apex is rather acute. The whorls are strongly convex; base very convex, impressed around the oblique perforation. The aperture is broadly lunate. Columellar margin is dilated upward.

Alt. 5, diam. 6.1 mm.; $5\frac{3}{4}$ whorls.

The pedal grooves are well-marked, rising at the tail. There is a wedge-shaped caudal pore, a short, blunt horn above it. The top of the tail is rounded. Sole narrow, tripartite.



Fig. 1. *Guppya calverti*. Fig. 2. *Guppya costaricana*. Fig. 3. *Guppya c. elatior*.

This species is closely related to *G. trochulina* (Morel.), of which *Helix selenkai* Pfr. has been shown to be a synonym.⁴ It differs by the slightly concave outlines of the spire, the greater convexity of the individual whorls, the higher first whorl and the microscopic sculpture, the vertical striae being much more distinct and the spirals closer. In topotypes of *selenkai* from Dr. Berendt, the original collector, the spirals are far more widely spaced (as noted by von Martens also for a paratype of *trochulina*), and they continue on the last whorl, while the vertical striation is so weak that it has not been noticed by any of the authors who have treated of *trochulina* or *selenkai*.

The Canal Zone species of this group, *Guppya browni* Pils., has the straight contour of *trochulina*, but it differs by the very distinct and beautiful microscopic sculpture.

⁴ BIOLOGIA, p. 120.

Guppya costaricana elatior n. subsp. Fig. 3.

Brook near the Rio Reventazón, Juan Viñas, at 2500 ft. Type No. 105276, A. N. S. P.

The shell is smaller than *costaricana* but with nearly the same number of whorls; more elevated, with the peripheral carina stronger; outlines of the spire more concave.

Alt. 4, diam. 4 mm.; $5\frac{1}{2}$ whorls.

Zonitoides hoffmanni (v. Martens).

Bank of Rio Reventazón, Cachi. Mar. 10, 1910. 3300 ft.

ACHATINIDÆ.

Subulina octona (Brug.)

Near town of Turrialba, 2200 ft.

Opeas beckianum (Pfr.)

Banana River, 30 ft. Nov. 10, 1910.

BULIMULIDÆ.

Oxystyla princeps (Brod.)

Forest, Guacimo.

Oxystyla ferussaci tricineta (v. Martens).

Bonnefil Farm, Rio Surubres, 700 ft.

Drymaeus sulphureus (Pfr.)

Near Guapiles, 980 ft.; Bonnefil Farm, Rio Surubres, 700 ft., on *Heliconia*, Oct. 16–21, 1909; Reventazón valley near Juan Viñas, 2500 ft., in a Bromeliad. Also on the road to Rio Reventazón at 3000 ft.

Calvert notes that the living animal, from the last locality, has the foot greenish-blue with whitish edges, the tentacles greenish-brown. Those from the first three localities have the rather short form of var. *citronellus* (Angas); the fourth is a longer shell.

Drymaeus costaricensis (Pfr.)

Juan Viñas, on a Bromeliad; also road to Rio Reventazón, 2500–3000 ft.; Cachi, 3450 ft.

A second lot from Cachi, on *Solanum*, consists partly of more slender shells, in contour resembling *D. attenuatus*, but associated with others of stouter contour, all having the coloration of *costaricensis*.

Drymaeus attenuatus pittieri (v. Martens).

Road from Juan Viñas to Rio Reventazón, 3000 ft. One specimen with typical markings. There is another from Juan Viñas,

2500 ft., without dark markings, which seems to be an albino mutation of *pittieri*, parallel to the mutation *concolor* of eastern Mexico rather than directly referable to that form.⁵ Von Martens has noted that in the State of Vera Cruz "the white variety [mut. *concolor*] has been found with typically colored specimens" of *D. attenuatus*.

***Drymaeus josephus* (Angas).**

A shell of the uniform white mutation was taken at Guapiles by D. E. Harrower.

SUCCINEIDÆ.

***Succinea recisa* Morelet.**

Juan Viñas, nearer waterfall, 3300 ft.

***Succinea guatemalensis* Morelet.**

Rio Reventazón, foot of waterfall near bridge, below Juan Viñas; also at 2500 ft. on petiole of "Hoja de Pato";⁶ near Cachi, 3450 ft.

PHYSIDÆ.

***Aplera fuliginea* (Morelet).**

S. Isidro del Tejar, 4500 ft.

***Aplera spiculata guatemalensis* Fischer & Crosse.**

Ditch at the south end of Cartago and other places about the city, 4750 ft.; Rio Zapote at confluence with Rio Reventazón, Cachi, 3450 ft.

PLANORBIDÆ.

***Planorbis tenuis* Phil.**

Rio de la Canas north of Santa Cruz, Guanacaste, abundant.⁷ 150 ft.

***Planorbis caribaeus* Orb.**

East of Cartago and four miles southwest of the same place; S. Isidro del Tejar, 4500 ft.

***Planorbis hondurasensis* Clessin.**

Ditch along the road from San José to La Verbena, 3800 ft.

⁵ Cf. Brolley, Moll. terr. y fluv. de la meseta central de Costa Rica, 1897, p. 13.

⁶ "An Aroid plant with gigantic arrow- or heart-shaped leaves and strong, partly recumbent stems three to six inches thick." A Year of Costa Rican Natural History, pp. 167, 334.

⁷ A Year of Costa Rican Natural History, p. 469.

ANCYLIDÆ.

Uncancylus calverti n. sp. Fig. 4.

Brook near Rio Reventazón, Juan Viñas, 2500 ft., Apr. 28, 1910. Type and paratypes, No. 105277, A. N. S. P.

The shell is oval, moderately elevated, the altitude half the width, the apex acute, recurved or hooked, at the posterior fourth of the length and about half way between the median line and the right margin. The anterior and left slopes are convex above, nearly straight near the margins; posterior strongly concave, the right slope much less so. Isabella colored, rather opaque, not glossy. Sculpture of many raised striae radiating from the summit, a few in the middle, anteriorly, coarse, the rest fine and narrow; on the sides and behind they are scarcely to be seen except by transmitted light. The interior has a translucent-whitish layer.

Length 7.4, width 4.6, alt. 2.3 mm.

Ancylus concentricus Orb., which appears to be nearly related, is less symmetrical in contour, with the apex further towards the right, and with about the same length it is more elevated.

Ancylus radiatus Guilding,⁸ which is known to me only from Guilding's account, resembles *A. calverti* in sculpture, but it is narrower relative to the length, if Guilding's figures are accurate; moreover, the apical part is not abruptly narrowed near the tip, as it is in *U. calverti*. Practically all authors who have considered the question agree in considering *A. excentricus* Morel. identical with *A. radiatus*. The former is a well known species, quite distinct from *U. calverti*.

The writer is indebted to Dr. Bryant Walker for reviewing the determination of this species, and indicating differences from *A. radiatus*. He also called attention to an error in H. & A. Adams, "Genera of Recent Mollusca", II, p. 265, pl. 84, fig. 5, said to represent *A. radiatus*, but really copied from one of Guilding's figures of *A. irroratus*. This mistake has been perpetuated in the works of Bourguignat and Clessin.

The genus *Uncancylus* is new to North America. The known species are chiefly Brazilian. It was proposed for South American Ancyli with the spire strongly hooked towards the right side, the shell therefore sinistral. Type *Ancylus barilensis* Moric.⁹

⁸ *The Zoological Journal*, III, 1828, p. 536, Suppl. pl. 26, figs. 7, 8, 9. On dead leaves in ditches, St. Vincent.

⁹ *Proc. A. N. S. Phila.*, 1913, p. 671.

This species is closely related in shell characters to the type of the genus *Uncancylus*. Since the teeth are unknown in that and other groups of South American Ancyliidae, and the system of the family, as developed by Dr. Bryant Walker, is largely based upon the modes of specialization of the teeth, its dentition becomes of interest.

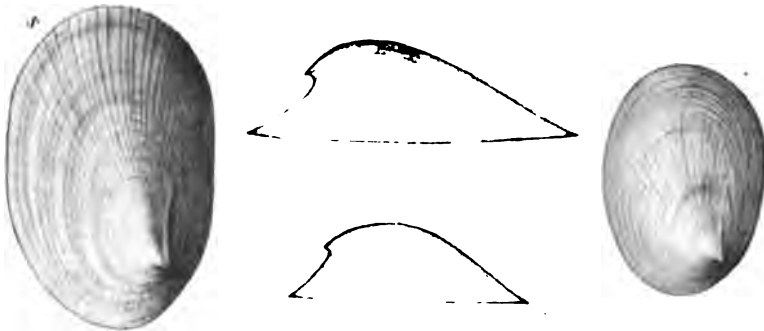


Fig. 4. Left and upper figures, *U. calverti*. Right and lower figures, *U. ameliae*.

In *U. calverti* there are 21-1-21 teeth in nearly straight transverse rows. The central tooth is bicuspid, the cusps very short, deeply separated. The laterals have three major cusps, the entocone and mesocone more or less united; between them and the ectocone there is a minute accessory cusp. Outside of the ectocone there is a minute cusp in the inner laterals, then two, and in the middle teeth of the lateral series, four or five little cusps. In some teeth a minute cusp appears between mesocone and entocone, and in the median and outer laterals another arises on the inner side of the entocone. The laterals are rather widely spaced, more so towards the edges of the radula. The basal plates are shorter than the cusps and very indistinct.

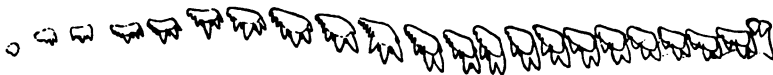


Fig. 5.—*Uncancylus calverti*, half row of teeth.

The jaw is long, slender, of wide, very short plates and with no lateral processes.

On comparison with the series of illustrations of Ancylid teeth prepared by Walker it is obvious that *Uncancylus* is closely related to the African genus *Burnupia* Walker. Except for the greater

development of small accessory cusps in the American species there is no material difference. No North American genus has similar teeth.

***Uncancylus ameliae* n. sp.** Fig. 4, left and lower figures.

Rio Zapote, at confluence with the Rio Reventazón, 3450 ft. March 4, 1910. Type and paratypes, No. 105260, A. N. S. P.

With a general resemblance to *U. calverti*, this species is smaller, relatively wider and higher. The periphery is elliptical, bilaterally symmetrical. Anterior and left slopes are convex, right slope concave and very steep, posterior slope somewhat concave; the apex recurved, hook-like, and very close to the right side, at the posterior sixth of the length. Isabella colored, without gloss. Sculpture of fine, thread-like radial striae, which are a little larger and more widely spaced in front.

Length 4.8, width 3.4, alt. 1.6 mm.

AMPULLARIIDÆ.

***Ampullaria flagellata* Say.**

Rio del Canas north of Santa Cruz, Guanacaste, 150 ft.

AMNICOLIDÆ.

***Amnicola tryoni* Pils.**

Brook near Rio Reventazón. Juan Viñas, 2500 ft. Four miles southwest of Cartago, 4500 ft. A very young specimen, probably of this species, was found attached to a dragonfly exuvia (*Palaemnema* sp.) at the nearer waterfall, Juan Viñas, 3300 ft. This species was originally described from Javali, in the Chontales district, Nicaragua, at 1750 ft.

UNIONIDÆ.

***Nephronaias tempisqueensis* n. sp.** Fig. 6.

Rio Tempisque, Filadelfia, Jan. 18, 1910, 50 ft. Type and paratypes (2 whole specimens and 4 valves), No. 105225, A. N. S. P.

The shell is oblong, the length slightly exceeding twice the alt., beaks at about the anterior third. The dorsal and ventral margins are but weakly convex, the anterior end rounded, posterior end obliquely subtruncate. The beaks are eroded, but little projecting. Surface somewhat glossy, under the lens showing very fine, hair-like and somewhat waved threads in the direction of growth lines, more prominent on the posterior end. Color deep colonial buff with numerous green rays. Interior white. The cardinal teeth are compressed, in the left valve subequal, strongly crenulated, the

single cardinal of the right valve high and oblique. The lateral teeth are smooth and not very long.

Length 28.3, alt. 15, diam. 10 mm.

" 30.7, " 16.3, " 9 "

This species stands near *N. macneilii* (Lea), but differs as follows: it is not biangular behind, is relatively longer, the striation less crowded. *N. dysoni* (Lea) is also broader with the cardinal teeth less compressed.



Fig. 6.—*Nephronaias tempisquensis*.

No species of the family has hitherto been reported from the Rio Tempisque, or from any Costa Rican stream draining into the Pacific.

MUTELIDÆ.

Anodontites luteolus (Lea).

Rio Tempisque, Filadelfia, Jan. 18, 1910, 50 ft. Lea's type of this species was said to be from the Isthmus of Darien, but his figures were drawn from a larger specimen from Lake Nicaragua (Gabb), No. 41833, A. N. S. P. In the single specimen from the Rio Tempisque the hinge line is straight instead of somewhat curved as in the type and that from Lake Nicaragua.

February 17.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Thirty-one persons present.

The deaths of the following members were announced: John A. Brown, Jr., A. Sidney Carpenter, Joseph M. Fox, Thomas C. Stellanwagen, and William K. Ramborger.

MR. HENRY W. FOWLER made a communication on: "Habits and Distribution of some of our Local Fishes." (No abstract.)

The report of the Committee on the Hayden Memorial Award conferring the gold medal on Professor Thomas Chrowder Chamberlin, Ph.D., LL.D., Sc.D., of the University of Chicago, was unanimously adopted.

THOMAS CHROWDER CHAMBERLIN was born in Mattoon, Illinois, September 25, 1843. He graduated from Beloit College in 1866, and received the degree of A.M. at the same institution in 1869. He pursued graduate studies at the University of Michigan from 1868 to 1869; he received the degree of Ph.D. from the University of Michigan and the University of Wisconsin in 1882. He received the degree of LL.D. from the University of Michigan, Beloit College, and George Washington University in 1887; from the University of Wisconsin in 1904; and from University of Toronto in 1913. He received the degree of Sc.D. from the University of Illinois in 1905. Doctor Chamberlin married, in 1867, Miss Alma Isabel Wilson, and has one son, who is now Professor Rollin T. Chamberlin, of the Geological Department of the University of Chicago.

Doctor Chamberlin was principal of the State Normal School, Delavan, Wisconsin, from 1866 to 1868, and was Professor of Natural Sciences at the State Normal School, Whitewater, Wisconsin, from 1869 to 1873. He was Professor of Geology at Beloit College from 1873 to 1882, and at George Washington University from 1885 to 1887. In 1887, he was elected President of the University of Wisconsin, which position he held until 1892, when he was appointed Professor of Geology and Head of the Department of Geology, and Director of the Walker Museum at the University of Chicago.

Doctor Chamberlin has carried on a vast amount of geologic research in a remarkably wide range of subjects. He was Assistant State Geologist of Wisconsin from 1873 to 1876, and Director of

the Geological Survey of Wisconsin from 1876 to 1882. During this time he produced the series of volumes entitled "The Geology of Wisconsin," which at once became the standard work on the geology of that region and is recognized the world over as of very great importance to the science of geology. In 1878, he represented the State of Wisconsin at the Paris Exposition.

During some years following this time, Doctor Chamberlin was largely engaged in researches in glacial geology, in which he was recognized as the chief authority in America. In 1878, he visited the glaciers of Switzerland; from 1882 to 1907 he was United States Geologist in charge of the Glacial Division of the United States Geological Survey; he was geologist of the Peary Relief Expedition in 1894. Somewhat later, Doctor Chamberlin became associated with the Carnegie Institution of Washington in research work; was a member of the University of Chicago Oriental Educational Investigation Committee in 1909; was Commissioner of the Illinois Geological Survey; and held many other positions. He was the recipient of medals at Paris in 1878 and 1893 in honor of his scientific work; and the Helen Culver Medal of the Chicago Geographical Society was bestowed on him in 1910. He is a corresponding member of the British Association for the Advancement of Science, and of the London and the Edinburgh geological societies.

After Doctor Chamberlin had gone to the University of Chicago he took up actively the investigation of some of the most fundamental problems of geology, the planetesimal hypothesis, the early history of the earth, the history of the atmosphere and other profound researches, and he is today recognized as the foremost scholar in the study of the fundamental principles governing the earth's origin and structure. He has written widely on this subject, both in the publications of the Carnegie Institution and elsewhere, and a remarkable volume produced a few years ago by him and entitled "The Origin of the World" shows his wonderfully clear conception of the subject.

In addition to the publications already mentioned, Doctor Chamberlin has for over fifty years been a voluminous writer in all the departments of geology to which he has given his attention. The "General Treatise on Geology," written by him and Professor R. D. Salisbury, is recognized as the standard text-book of geology in this country and abroad; and the wonderful ability with which he and Professor Salisbury have edited the *Journal of Geology* has commanded the admiration and respect of all their associates in the geological profession.

Professor Chamberlin is a member of the National Academy of Sciences, the American Philosophical Society, and many other scientific organizations. He was President of the American Association for the Advancement of Science in 1908; President of the Chicago Academy of Sciences in 1898 to 1914; and President of the Illinois Academy of Science in 1907. He is at present Professor Emeritus of Geology at the University of Chicago.

The following were elected Members: Hugh Bradshaw Meredith, Robert F. Welsh, Henry Carlisle Stewart, Edward Woolman, George F. Tyler, C. E. Tobias, Jr., W. G. McDaniel, Conrad K. Roland, Benjamin Rush, and George H. Stewart, 3rd.

The following paper was ordered to be printed:

STUDIES IN MALAYAN, PAPUAN, AND AUSTRALIAN MANTIDÆ.

BY MORGAN HEBARD.

During the past thirteen years the author has received by purchase from dealers in London, Paris and Berlin, several collections and numerous individual specimens of Orthoptera from the South Seas and adjacent continental areas. Recently a large number of species of Mantidæ, assembled by Mr. C. F. Baker in the Malay Peninsula, Borneo and the Philippines, have been received.

It was noted, upon assembling all of the Mantidæ represented, that a sufficient series was available to justify the undertaking of a study of the material of that family before us from the regions referred to above. Seventy-eight species, representing forty-one genera, are here treated, of which five genera and twelve species are described as new. The collections contain a very good representation, including many of the most remarkable and little known forms. Though in some of the groups only a minimum of the known species are before us, we feel that, on the whole, the collection is one of the most complete, for the Malayan region in particular, now extant in any of the world's museums.

This is in large part due to the efforts of Mr. C. F. Baker, and when we consider that he is forming collections in all orders of insects, we feel that he should be heartily congratulated on his achievements to date. It is our sincere hope that his work may continue successful and uninterrupted for many years to come.

All of the material treated in the present paper, unless otherwise assigned, is in the Hebard Collection at the Academy of Natural Sciences of Philadelphia, with the exception of duplicate specimens from Mr. Baker, of species which are not represented in his collection; these will be forwarded to him whenever desired.

We have included the species from the Malayan, Papuan and Australian regions, as some of the forms of each of these interdigitate over extensive areas with those of the regions adjacent. We would note, however, the vital importance of Wallace's Line, separating the Malayan and Papuan faunas. The great majority of species found in the Malay Peninsula, Sumatra, Java, Bali, Borneo and the Philippines, have little in common with those of

Lombok, the Timor Group, Celebes, the Moluccas, Salwatty, Borneo and the Aru, and Ké Islands, and vice versa.

The geographical distribution and affinities of the species is shown by the following table. An "a" indicates that a form of close affinity is found in the region so checked.

Name of Species	Malayan	Papuan	Australian
<i>Paraozypilus verreauxii</i> Saussure	—	—	*
<i>Amorphoscelis borneana</i> Giglio-Tos	*	—	—
<i>Metalliticus violaceus</i> (Burmeister)	*	—	—
<i>Theopompula ocularis</i> Saussure	*	—	—
<i>Theopompa burmeisteri</i> (Haan)	*	—	—
<i>Orthodera ministralis</i> (Fabricius)	—	—	*
<i>Bolbe pygmaea</i> (Saussure)	—	—	*
<i>Hapalopiza tigrina</i> Westwood	*	—	—
<i>Epsomantis tortricoides</i> (Haan)	*	—	—
<i>Tropidomantis tenera</i> (Stål)	*	—	—
<i>Neomantis australis</i> (Saussure and Zehntner)	—	—	*
<i>Kongobatha diademata</i> new species	—	—	*
<i>Xanthomantis flava</i> Giglio-Tos	*	—	—
<i>Polyacanthopus mantispoides</i> new species	*	—	—
<i>Sceptluchus simplex</i> new species	*	—	—
<i>Stenomantis novae-guineae</i> (Haan)	—	*	a
<i>Amantis reticulata</i> (Haan)	*	—	—
<i>Amantis maculata</i> (Shiraki)	Formosa	—	—
<i>Amantis aeta</i> new species	*	—	—
<i>Amantis basilana</i> new species	*	—	—
<i>Gonypeta borneana</i> Giglio-Tos	*	—	—
<i>Compsomantis semirufula</i> (Westwood)	*	—	—
<i>Opsomantis tumidiceps</i> (Bolivar)	*	—	—
<i>Euchomenella heteroptera</i> (Haan)	*	—	—
<i>Euchomenella molucarum</i> (Saussure)	*	*	—
<i>Tagalomantis manillensis</i> (Saussure)	*	—	—
<i>Haania lobiceps</i> (Haan)	*	—	—
<i>Caliris masoni</i> (Westwood)	Oriental	—	—
<i>Caliris elegans</i> Giglio-Tos	*	—	—
<i>Gilda suavis</i> Giglio-Tos	*	—	—
<i>Leptomantis albella</i> (Burmeister)	*	—	—
<i>Leptomantis fragilis</i> (Westwood)	*	—	—
<i>Leptomantis lactea</i> (Saussure)	*	—	—
<i>Leptomantis tonkinae</i> new species	Tonkin	—	—
<i>Aetaella bakeri</i> new species	*	—	—
<i>Deroplatys desiccata</i> Westwood	*	—	—
<i>Deroplatys truncata</i> (Guerin)	*	—	—
<i>Sphodropoda tristis</i> (Saussure)	—	*	*
<i>Sphodropoda quinquedens</i> (MacLeay)	—	—	*
<i>Statilia maculata</i> (Thunberg and Lundahl)	*	*	—
<i>Statilia nemoralis</i> (Saussure)	*	*	—
<i>Tenodera aridifolia</i> (Stoll)	*	—	a
<i>Tenodera attenuata</i> (Stoll)	*	—	—
<i>Tenodera blanchardi</i> Giglio-Tos	—	*	*
<i>Mesopteryx alata</i> Saussure	*	—	—
<i>Hierodula gracilicollis</i> Stål	*	—	—
<i>Hierodula vitrea</i> (Stoll)	*	—	—
<i>Hierodula venosa</i> (Olivier)	*	a	—
<i>Hierodula rajah</i> Werner	—	*	—
<i>Hierodula patellifera</i> (Serville)	*	—	—
<i>Hierodula aruana</i> Westwood	—	*	—
<i>Hierodula laevicollis</i> Saussure	—	*	—

<i>Hierodula obiensis</i> new species	-	*	-
<i>Hierodula sorongana</i> (Giglio-Tos)	-	*	-
<i>Hierodula denticulata</i> (Krauss)	-	*	a
<i>Hierodula splendida</i> new species	-	*	a
<i>Rhombodera extensicollis</i> (Serville)	*	-	-
<i>Rhombodera stalii</i> Giglio-Tos	*	-	-
<i>Rhombodera basalis</i> (Haan)	*	-	-
<i>Rhombodera valida</i> Burmeister	*	-	-
<i>Rhombodera saussurii</i> Kirby	-	*	-
<i>Archimantis latistyla</i> (Serville)	-	-	*
<i>Archimantis armata</i> Wood-Mason	-	-	*
<i>Oligomantis orientalis</i> Giglio-Tos	*	-	-
<i>Acromantis moulloni</i> Giglio-Tos	*	a	-
<i>Acromantis oligoneura</i> (Haan)	*	*	-
<i>Acromantis luzonica</i> new species	*	-	-
<i>Acromantis hesione</i> Stål	*	a	-
<i>Acromantis australis</i> Saussure	a	*	-
<i>Acromantis dyaka</i> new species	*	a	-
<i>Odontomantis javana javana</i> Saussure	*	-	-
<i>Odontomantis javana euphrosyne</i> Stål	*	-	-
<i>Hymenopus coronatus</i> (Olivier)	-	*	-
<i>Creobroter granulicollis</i> Saussure	*	-	-
<i>Creobroter labuanæ</i> new species	*	-	-
<i>Creobroter meleagris</i> Stål	*	-	-
<i>Creobroter episcopalis</i> Stål	*	-	-
<i>Theopropus elegans</i> (Westwood)	-	*	-

A NOTE ON THE RECENT REVISIONARY WORK ON THE MANTIDÆ.

The Mantidæ as a whole have never been satisfactorily revised. Of recent years, Dr. Ermanno Giglio-Tos has done much revisionary work and, as a forerunner to his monograph of the family, has published a pamphlet, giving the arrangement of the family according to his findings.¹ The work of that author to date is seriously marred by an utter lack of figures throughout, with the exception of one paper, while his generic and specific descriptions are in almost all cases deplorably insufficient. Had the studies been based on a large collection, it could be hoped that, at some future time, that author or another could more adequately diagnose the new genera and species involved. Unfortunately the material used as a basis for this work was gathered from many European institutions and once returned will make an adequate and comprehensive final study a most difficult matter.

Though the number of new genera described by Giglio-Tos at first glance appeared inordinately large, we believe that the great majority will prove valid. It is clear that the generic units, as previously recognized in the Mantidæ, were composed of many distinct forms, and the separation of these into logical units constitutes the most useful portion of his contributions.

¹ Bull. Soc. Ent. Italiana, XLIX, pp. 50 to 87 (1919).

Of the new species described by that author, we regret to state that a considerable percentage appear to be of doubtful validity. In some cases mere color variants have been described as new species. Geographic racial differentiation is ignored. It is clear that we here have another example of the specialist whose activities have apparently been wholly, or in large part, limited to the study of museum specimens.

The situation shows the absolute necessity at the present time, of the specialist, working on a particular group of insects, to have a first hand knowledge of the forms in nature. The significance of differences observed, whether due to individual size or color variation, or genetic factors, or to local environmental influences, or to geographic distribution and in this respect whether or not of racial value, or constituting valid diagnostic criteria of specific or generic value, can otherwise hardly be fathomed.

In making this statement the author is not influenced by prejudice, but is speaking from experience, acquired through many months of field work in regions where a considerable number of species of the Mantidæ occur.

SYSTEMATIC TREATMENT.

I. PERLAMANTINÆ¹.

1ST GROUP, PARAOXYPII.

Paraoxyphilus verreauxi Saussure

1870. *P[araoxyphilus] verreauxii* Saussure, Mélang. Orth., I, p. 305. [♂, Tasmania.]

Townsville, Queensland, Australia, 2 ♂.

This remarkable little insect has been further recorded from southern Australia by Saussure and from Peak Downs, Queensland, Australia, by Sjostedt. The pronotum is figured by Giglio-Tos.²

2D GROUP, PERLAMANTES.

Amorphoscelis borneana Giglio-Tos.

1913. *A[morphoscelis] borneana* Giglio-Tos, Gen. Ins., Fasc. 144, Orth., Mantidae, Perlantinae, p. 9. [♀, Borneo.]

Jelabu, British Straits Settlements, Malay Peninsula, 1 ♀.

¹ The subfamilies and groups as given by Giglio-Tos are indicated throughout the present paper. This does not mean that we indorse his system. We do believe, however, that it is the most satisfactory to date and should be followed pending further comprehensive revisionary work.

² Gen. Ins., Fasc. 144, Orth., Mantidæ, Perlantinae, pl. figs. 2a and 2b (1913).

This specimen agrees fully with the original description, except that the pronotum is two millimeters in length, one millimeter less than the pronotal length given by Giglio-Tos.⁴

II. EREMIAPHILINÆ.

1ST GROUP, METALLYTICI.

Metallyticus violaceus (Burmeister).

1838. *M[etalleutica] violacea* Burmeister, Handb. Ent. II, Abth. II, pt. I, p. 527. [Java.]

Zamboanga, Zamboanga, Mindanao, Philippine Islands, (from C. F. Baker), 1 ♀.

In the present specimen the head is without pale markings; the pronotum, in addition to two pale maculations meso-laterad at the caudal margin, has the medio-longitudinal sulcus pale from the transverse sulcus over half the distance to the caudal margin.

Though this species is remarkable in being strikingly metallic in general coloration, it is by no means as brilliant as other species of the genus.

4TH GROUP, HUMBERTIELLÆ.

Theopompula ocularis (Saussure).

1872. *H[umbertiella] ocularis* Saussure, Mélang. Orth., II, p. 16. [♀, Borneo.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂.

Labuan Island, British North Borneo, 1 ♀.

This and the following species so closely resemble species of the American genus *Gonatista*, that we believe they will be found to have very similar habits, living on the trunks of trees, about which they run with amazing rapidity.

Theopompa burmeisteri (Haan).

1842. *M[antis] (Mantis) burmeisteri* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 80, pl. XVI, figs. 3 and 4. [♂, ♀, Java.]

1917. *T[heopompa] borneana* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVIII, p. 85. [♂, ♀, Borneo.]

Giglio-Tos states that his *borneana* is very similar to *burmeisteri* and gives certain features of coloration as the important differential characters. The first of these, costal area of female tegmina as transparent as in male, is apparently of no value, this being clearly shown by Haan's figures to be true for *burmeisteri*. In the other

⁴ This may be due to a typographical error. The genus is described by that author as having the pronotum broader than long, but the dimensions for *borneana* are given as length 3, width 2.5 mm.

features of coloration, it would appear that a certain amount of differentiation in Giglio-Tos' material is clearly ascribable to individual variation. The present specimens all have the internal spines of the cephalic tibiae black at their apices. We therefore do not feel justified in recognizing *borneana* either as a valid species or race.

Jelabu, British Straits Settlements, Malay Peninsula, 1 ♂.

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂, 1 ♀.

The present specimens measure as follows: length of pronotum ♂ 8.8 to 9, ♀ 13.9; width of pronotum ♂ 6 to 6.4, ♀ 9; length of tegmen ♂ 40.8 to 41, ♀ 53 mm.

The two males at hand, though from very widely separated localities, are extremely similar, that from Jelabu slightly the paler in general coloration and very slightly the larger.

10TH GROUP, ORTHODERÆ.

Orthodera ministralis (Fabricius).

1775. *M[antis] ministralis* Fabricius, Syst. Ent., p. 277. [Australia.]

Queensland, Australia, 1 ♀.

III. IRIDOPTERYGINÆ.

2ND GROUP, IRIDOPTERYGES.

Bolbe pygmaea (Saussure).

1871. *A[meles] pygmaea* Saussure, Mélang. Orth., I, p. 423. [♂. North Australia.]

Queensland, Australia, 1 ♂.

The present species, one of the smallest of the described forms of the Mantidæ, is now known to have a wide distribution on the Australian Continent. The present specimen measures as follows: length of body 12,⁶ length of pronotum 2.4, width of pronotum 1.2, length of tegmen 9.8, width of tegmen 2.7 mm.

Hapalopeza tigrina Westwood.

1889. *Hapalopeza tigrina* Westwood, Rev. Ins. Fam. Mantidarum, p. 37, pl. XIV, fig. 13. [Singapore, [Straits Settlements]; Sarawak, [Borneo]; Sumatra.]

Sandakan, British North Borneo, (from C. F. Baker), 2 ♂, 5 ♀.

Labuan Island, British North Borneo, 2 ♀.

The present is the only known species of this Asiatic genus found in Borneo.

⁶ Somewhat crushed out, this dimension having probably been less in life.

3D GROUP, TROPIDOMANTES.

***Epsomantis tortricoides* (Haan).**

1842. *M[antis] (Mantis) tortricoides* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 82, pl. XVIII, fig. 4. [♂, Java.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂.

This species has been referred to *Platycalymma* by Westwood⁶ and to *Ecinophlebia*, with a query by Saussure and Zehntner.⁷ Giglio-Tos⁸ has erected the genus *Epsomantis* to include this one species, considering it separable from the Madagascar species of the other two genera by the tegmina having the costal area near the base much broader, nearly equalling half the total tegminal width, the pronotum with prozonal margin dilated and submembraneous and the cephalic tibiae provided with eight external spines. This latter feature is shown by Haan's figure, but we believe that the number was actually different, as well as features of venation. We are led to suppose that the specimen before us represents the first individual of this extraordinary insect taken since the type.

In consequence, we would note the following features, some of which we believe to be of generic diagnostic value, in addition to those given by Giglio-Tos. We therefore retain *Epsomantis* as a valid genus.

Pronotum with lateral margins microscopically denticulate, dorsal surface with a medio-longitudinal depression, in which, on the shaft, a very delicate and smooth carina is developed.⁹ Tegmina with humeral vein with one conspicuous branch distad, median vein paralleling humeral vein to median portion, then strongly diverging from it, discoidal vein with four distinct branches, which themselves branch near the sutural margin. Cephalic femora with ventro-external margin bearing five spines, in addition to the small genicular spine, with a series of minute spinulae intercalated between these; ventro-internal margin with the following formula of spines, II|II|II|II|II|I, the long spines all being directed inward, the last being a small genicular spine. The tibiae have fourteen to fifteen external

⁶ Rev. Ins. Fam. Mantidarum, p. 40, (1889).

⁷ In Grandidier, Hist. Nat. Madagascar, XXIII, Orth., p. 177, (1895).

⁸ Bull. Soc. Ent. Italiana, XLVI, p. 47, (1915).

⁹ This violates the group character given by Giglio-Tos, "metazona del pronoto munita di una carena ben distinta che si estende in parte anche sulla prozona." We are, however, satisfied that this remarkable species is an aberrant member of the Tropidomantes.

and fifteen to sixteen internal spines, which increase regularly in size and length distad.¹⁰

In life the specimen was probably a very delicate pale green. The body and limbs have now faded to yellowish, except for three small and regularly placed dots on the external face of each cephalic femur, which are very rich green. The tegmina are very pale lumiere green. Mesad across the humeral field is a narrow irregular transverse band, formed by a faint tracery along the veinlets of this area of vinaceous; there is also a minute fleck of the same meso-proximad in the humeral field.

Though Haan's figure shows fewer spines and a much more simple tegminal venation, we believe that these differences are wholly due to a certain amount of inaccuracy on the part of the artist.

***Tropidomantis tenera* (Stål).**

1858. *Mantis tenera* Stål, Kongl. Svenska Freg. Eugenies Resa, Ins., p. 314. [♀; Singapore, [Straits Settlements].]

Zamboanga, Zamboanga, Mindanao, Philippine Islands, (from C. F. Baker), 1 ♀.

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 2 ♀.

Penang Island, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♂, 2 ♀.

The Zamboanga and Penang females are slightly larger, with pronotum slightly heavier, than those from the type locality.

***Neomantis australis* (Saussure and Zehntner).**

1895. *Tropidomantis australis* Saussure and Zehntner, in Grandidier, Hist. Nat. Madagascar, XXIII, Orth., p. 169. [♂; Queensland, Australia.]

Townsville, Queensland, Australia, 2 ♂.

The very broad oval, pale green tegmina give this little insect a distinctive appearance. The minute black dots on the costal margin of the tegmina are an interesting feature.

¹⁰ We would here note that the spine formulae of the cephalic femora and tibiae is most important in the Mantidæ and not always easy to record accurately. For the femora we find on the ventro-external margin a few, usually long, spines; on the ventro-internal margin more numerous spines, usually alternating in length proximad, and in addition to these should be noted separately the usually minute genicular spines, when present, and the very important discoidal spines, which proximad run in an oblique line across the ventral surface of the femur. Three or four of these occur and it is particularly important not to confuse one or two of these nearest the margin with the marginal spines proper. In the tibiae the formulae are more simple. All of the external spines must be counted, but in counting the ventro-internal spines great care must be taken not to include the apical claw, which is much larger and longer than any spine and projects from the dorso-distal portion of the tibia, but might easily be mistaken for the terminal spine of the ventro-internal series.

KONGOBATHA¹¹ new genus.

In the arrangement of the Mantidæ we place this genus after *Neomantis*. From all known genera of the *Tropidomantes* the present is separated by the strongly elevated lateral portions of the vertex and the slender pronotum, which shows a minimum development of the medio-longitudinal carina;¹² in the majority of genera of the *Tropidomantes* this carina being very decided and lamellate. The insect is much more attenuate than in *Tropidomantis* and consequently very much more attenuate than in *Neomantis*, but the spination of the ventro-internal margin of the cephalic femora and very elongate supra-anal plate agrees instead with the latter genus.

Genus monotypic. GENOTYPE.—*Kongobatha diademata* here described.

Generic description (from female, male unknown).—Size small, normal for the *Tropidomantes*. Form slender, tegmina and wings much narrower than in *Tropidomantis*, narrower even than in *Xanthomantis*, with apices acute and sharply rounded. Head much less transverse than in *Tropidomantis* and *Neomantis*, facial scutellum very strongly transverse, occiput distinctly quadrisulcate, the juxta-ocular portions raised high above the eyes in blunted angulate projections, the median sections much lower, somewhat swollen but with dorsal margin transverse.¹³ Ocelli moderately well developed, forming a triangle very slightly broader than high. Pronotum slender, slightly longer than cephalic coxa, margins smooth; supra-coxal expansion very weak with its margins very feebly and broadly convex; medio-longitudinal carina decided, but not as strongly developed or lamellate as is usual in the *Tropidomantes*, completely severed by the supra-coxal transverse sulcus, disappearing mesad on collar of pronotum. Tegmina with veins as characteristic for the group; false veins regular, not irregular as in *Tropidomantis* or very irregular as in *Neomantis*; marginal field very narrow, with its immediate margin opaque; other portions of tegmina and wings hyaline. Wings projecting slightly beyond tegmina. Cephalic coxa with margins unarmed but showing a few very minute hair follicles, which are more numerous along the straight dorsal margins of the cephalic femur. Cephalic femur

¹¹ One of the aboriginal tribes of Queensland.

¹² Excepting, as to this feature, the aberrant *Epsomantis tortricoides* (Haan).

¹³ Evidently a high specialization of the type shown by *Tropidomantis*.

slender, with unguicular sulcus at end of proximal two-fifths; three discoidal spines; four spines on ventro-external margin and an additional small spine on external and internal genicular lobe; between but inside the first two spines of the ventro-external margin is a small round concavity into which, when the limbs are flexed, fits the apex of the terminal spine of the ventro-external margin of the cephalic tibia; spine formula on ventro-internal margin I I I I I I I I. Cephalic tibia with ventro-external margin armed with nine spines, increasing in length distad, except that the second is longer than the third and the fourth longer than the fifth; ventro-internal margin armed with eleven spines which increase regularly in length distad. Caudal metatarsus very slightly longer than the combined length of the succeeding tarsal joints. Cerci absent in specimen at hand. Supra-anal plate very elongate.

Kongobatha diademata new species. (Plate I, figures 1 and 2.)

The form of the specialized vertex is a very distinctive feature in this species. The insect does not look like the other species of the *Tropidomantes* and it is only when closely examined that the affinity is apparent, the head and pronotum being then seen to show only a distinctive development from the same type found in *Tropidomantis*.

TYPE.—♀; Queensland, Australia. [Hebard Collection Type No. 518.]

In addition to the features given in the generic description, we would note the following. Facial scutellum five times as broad as high. Short, somewhat irregular, oblique veinlets connect the marginal and mediastine veins of the tegmina and of the wings proximad only. Stigma indicated as a colorless line running from the discoidal to near the humeral vein, beyond which from a number of irregularly confused veinlets springs the median vein. Wings with distal portion of anterior field as long as its basal width, discoidal vein triramose. Cephalic femora with ventral surface supplied with hairs and within the marginal spines minutely and irregularly denticulate; spines of ventro-internal margin extend to opposite distal margin of femoral brush, the first two and the last of the longer spines exceeding the other longer spines very slightly in length. Supra-anal plate fully twice as long as basal width, lateral margins weakly concave convergent proximad, thence straight in the gradually narrowing slender distal portion to the acute apex, which extends well beyond the comparatively elongate subgenital plate.

Body and limbs immaculate; probably discolored,¹⁴ yellowish brown. Eyes blackish chestnut brown. Tegmina and wings hyaline, strongly iridescent, except very narrowly along the costal margin of the tegmina, which portion, not more than a third the distance between the marginal and mediastine veins proximad, is opaque, yellowish brown.

Length of body 24.5, length of pronotum 5.7, length of pronotal collar 2, greatest width of pronotum 1.8, length of tegmen 16.5, width of marginal field of tegmen .8, length of wing 16.3, length of cephalic femur 5.8, length of caudal metatarsus 1.7 mm.

The type of this interesting species is unique.

***Xanthomantis flava* Giglio-Tos.**

1915. *X[anthomantis] flava* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVI, p. 53. [♀, Borneo.]

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♀.

The striking yellow coloration of the entire marginal fields of the tegmina and of the distal portion of the entire marginal fields of the wings, which are otherwise clear hyaline and iridescent, gives this specimen a close resemblance to individuals of certain species of the Neuropteroid genus *Mantispa*. Small lateral flecks of purple are found on the facial scutellum, this color appearing as a hairline, margining the opaque marginal portions of the tegmina and wings.

The strong lamellate medio-longitudinal carina of the pronotum is completely and suddenly cleft by the supra-coxal transverse sulcus, which carina only extends a brief distance on the collar in the specimen before us. Counting from the base to the apex of the cephalic tibia, the spines of the ventro-external margin increase in length distad, except the second and sixth, which are very long and the tenth which is slightly longer than the eleventh and last spine. Though the cerci are damaged, the last joint is seen to be nearly five times as long as its greatest width, the preceding joints slightly longer than wide. Giglio-Tos has not mentioned this feature and the spine formula for the cephalic tibia would appear to have been counted from the apex proximad, the type having two instead of three small spines between the second and sixth.

¹⁴ The feet are greenish, which leads us to believe that, in life, this insect may be pale green.

POLYACANTHOPUS new genus.

This genus shows very close affinity to *Xanthomantis* in general form and tegminal and wing structure, but differs particularly in the different ocellar arrangement, weaker armament of the ventro-internal margins of the cephalic femora, remarkably heavy armament of the cephalic tibiae and in the percurrent pronotal carina.

The armament of the cephalic tibiae is heavier than in any species of the Mantidae we have ever seen.

Genus monotypic. GENOTYPE.—*Polyacanthopus mantispoides* here described.

Generic Description.—Size small, normal for the Tropicodromes. Form slender, tegmina and wings narrower than in *Tropicodromis*, but with apices rather broadly rounded, similar to the type developed in *Xanthomantis* and suggesting the type found in the widely separated genera *Leptomantis* and *Aetaella*. Head broad, facial clypeus transverse with dorsal margin scarcely defined, occiput scarcely raised above eyes, showing a broad and weak concavity mesad, these features as in *Xanthomantis*. Ventral ocellus smaller than the dorsal pair of ocelli and placed at a slightly greater distance from them than the width between them. Pronotum slender, slightly longer than the cephalic coxa, margins smooth, supra-coxal expansion weak with its margins broadly convex, medio-longitudinal carina heavy, lamellate, percurrent, completely severed by the transverse supra-coxal sulcus; in all these features agreeing with *Xanthomantis*, except that in that genus the carina disappears before reaching the cephalic margin of the collar. Tegmina and wings narrow, with venation as characteristic for the group, clear hyaline except external section of marginal field of tegmina and distal portion of external section of marginal field of wings, which very narrow portions are opaque, wings projecting well beyond tegmina; these features giving to the insect a decided general resemblance to *Xanthomantis* and causing individuals of these genera to have a close superficial resemblance to certain Neuropteroid genera of the subfamily Mantispinae. Cephalic coxa with margins smooth. Cephalic femur slender, dorsal margin straight and smooth, unguicular sulcus near base; three discoidal spines; ventro-external margin with four elongate and slender spines, between but slightly outside of the first two of which is a small round concavity, into which fits the apex of the terminal spine of the ventro-external margin of the cephalic tibia when the limbs are flexed, genicular areas unarmed; spines on ventro-internal margin fewer and not

alternating in length to the marked degree found in *Xanthomantis*. Cephalic tibia with ventro-external margin armed with very numerous (twenty-five and twenty-six) and closely placed spines increasing in length distad but with two in the series and two before the very elongate terminal spine much more elongate; ventro-internal margin armed with very numerous (twenty-five) and closely placed spines, elongate and slender and increasing slightly in length distad, except the proximal spines which are very small. Caudal limbs absent from the specimen at hand. Cerci slender, moderately elongate, terminal joint very elongate oval; these appendages much as in the specimen of *Xanthomantis* before us. Apex of abdomen crushed in specimen under consideration.

***Polyacanthopus mantispoides* new species.** (Plate I, figures 3 and 4.)

The present species shows a very close general resemblance to *Xanthomantis flava* Giglio-Tos; having, however, many important differences as given in the generic description.

Specialization, considering the astonishingly great numerical abundance of spines on the cephalic tibiae, would appear to have reached a condition almost detrimental to the effectiveness of the grasping limbs in the present species.

TYPE.—♂; Sandakan, British North Borneo. (From C. F. Baker.) [Hebard Collection Type No. 517.]

In addition to the features given in the generic description, we would note the following for this remarkable species. Dorsal pair of ocelli very large, ventral ocellus large. Occiput, immediately above these, showing a small but well defined convexity, with a minute but distinct transverse carina and a vertical carina extending briefly dorsad, the juncture of these carinae forming a weak median projection. Internal margins of eyes concave and weakly divergent dorsad.¹⁵ Medio-longitudinal carina of pronotum strongly developed and lamellate, as is characteristic of the group *Tropidomantes*. Short, straight, transverse veinlets occur in the opaque portion of the marginal fields of the tegmina and wings, connecting the marginal and mediastine veins. Stigma subobsolete. Apex of abdomen crushed. Cercus considerably less than twice as long as exposed portion of subgenital plate, segments increasing in length

¹⁵ In the female of *X. flava* at hand these margins are feebly concave and rather decidedly divergent dorsad, while in that specimen a minute but well developed tubercle is found on each side between the antennal sockets and the ocular margins.

distad, penultimate segment three-quarters as long as wide, last segment elongate ovate, three times as long as its greatest width, with apex moderately acute. Subgenital plate with lateral margins thickened, convergent, very feebly convex, to near median portion where these thickened portions terminate, the brief meso-distal portion of the margin weakly concave between the ridges which indicate style bases, no styles being developed in this specimen. Cephalic femur with ventro-internal margin armed with (twelve and thirteen) spines which alternate slightly in length,¹⁶ except in area below femoral brush, which portion of the margin is supplied with two or three minute spinulæ (not included in the above count). Cephalic tibia with the more elongate spines of the ventro-external margin the ninth, seventeenth, twenty-fourth and twenty-fifth on one limb, the eighth, sixteenth, twenty-third and twenty-fourth on the other limb,¹⁷ not including the longer distal spine of this margin.

Body and limbs immaculate; apparently discolored, yellowish brown. Eyes blackish chestnut brown. Tegmina and wings clear hyaline, very strongly iridescent, except narrow marginal area between marginal and mediastine veins, which in the tegmina is entirely opaque, colonial buff, in the wings similarly opaque, colonial buff, distad in this area.

Length of body 21, length of pronotum 5, length of pronotal collar 1.8, greatest width of pronotum 1.8, width of marginal field of tegmen .9, length of wing 15.5, length of cephalic femur 5.3 mm.

The type of this singular species is unique.

4TH GROUP, NANOMANTES.

SCEPTUCHUS¹⁸ new genus.

The present genus is apparently nearest in relationship to *Nanomantis* Saussure. It is seen to differ from *Nanomantis* in the more even contour of the occiput with juxta-ocular swellings very feebly indicated, weakly convex, carinate shaft of pronotum, smooth

¹⁶ So numerous and elongate are the spines of the opposed margin of the cephalic tibia when the limb is flexed that the present specimen shows the majority of the longer spines of this margin to have been broken, apparently by contact with these.

¹⁷ The difference indicated here for the two limbs is due to the fact that one limb has one less of the minute proximal spines than the other.

¹⁸ Wand Bearer, in allusion to the manner in which the Mantiidæ point with their cephalic limbs.

cephalic coxæ and apparently¹⁹ fewer spines on the ventro-internal margin of the cephalic femora.

Genus monotypic. GENOTYPE.—*Sceptuchus simplex*, here described.

Generic Description.—Size small, normal for the *Nanomantes*; form slender. Head decidedly transverse; facial scutellum very strongly transverse; occiput quadrisulcate, these sulci broad and shallow, the dorsal outline of the sections thus formed transverse, the juxta-ocular sections showing a very broad and feeble convexity. Ocelli moderately well developed, the dorsal pair vertical, very elongate oval in form, above which is a transverse and very delicate carina. Pronotum slender, slightly longer than cephalic coxa, margins smooth, supra-coxal expansion moderately developed with its margins moderately convex, medio-longitudinal carina distinct on shaft of pronotum, lying in a broad medio-longitudinal depressed area, absent on collar. Tegmina elongate and moderately narrow with apices rather broadly rounded, entirely hyaline, median and discoidal veins connected by an oblique hyaline linear stigma, transverse sigmoid veinlets broken mesad by delicate false veins only in distal portion of tegmina. The wings do not project beyond the tegmina. Supra-anal plate triangularly produced, not as long as proximal width. Cerci simple, cylindrical, tapering to acute apices. Coxa with margins smooth. Cephalic femur slender, with dorsal margin straight, pinched into a moderately decided ridge, unguicular sulcus at end of proximal two-fifths, three discoidal spines, four spines on ventro-external margin and an additional small spine on each genicular lobe, spine formula of ventro-internal margin I I I I I I I I I I I. Cephalic tibia with ventro-external margin armed with seven spines, increasing in length distad, of which the first is decidedly the smallest and separated a greater distance from the second than the intervals between the others; ventro-internal margin armed with eleven spines which increase in length distad. Caudal metatarsus extremely elongate and slender, over twice as long as combined length of succeeding tarsal joints.

Sceptuchus simplex new species. (Plate I, figures 5 and 6.)

The present species apparently shows nearest affinity to *Nanomantis australis* Saussure.²⁰ In addition to the differential features

¹⁹ Saussure gives for *Nanomantis australis*, the genotype, seven spines on the ventro-external margin of the cephalic femora in his key. In his supplementary diagnosis, however, he gives seven spines for that margin and ten for the ventro-internal margin, leaving some doubt as to the accuracy of this count.

²⁰ Mélang. Orth., I, pp. 264 and 435, pl. VII, figs. 64, 64a, 64b, (1870 and 1871).

given in the generic diagnosis, we would note that the present species appears to differ from all others, assigned to the group *Nanomantes* by Giglio-Tos, in the simple immaculate coloration of limbs and organs of flight.

TYPE.—♂; Singapore, British Straits Settlements, Malay Peninsula. (From C. F. Baker.) [Hebard Collection Type No. 519.]

In addition to the characters described in the generic treatment, we would give the following. Facial scutellum five times as broad as high; dorsal margin weakly defined, transverse mesad, oblique laterad. Antennæ and costal margins of tegmina microscopically ciliate. Short, straight, oblique or vertical veinlets connect the marginal and mediastine and mediastine and humeral veins of the tegmina and wings. Cephalic femur with ventral surface supplied with hairs and within the external spines somewhat angulately ridged and denticulate; ventro-internal margin with spines extending to opposite distal margin of femoral brush, alternating long and short, except the three successive smaller spines beneath femoral brush, the elongate terminal spine longer than any of the others. Supra-anal plate triangular, with apex rather broadly rounded. Subgenital plate with lateral portions narrowly curved upward; dextral portion evenly and weakly convex, sinistral portion straight in proximal half, then in remaining portion similarly convex and convergent with dextral portion; at the apices of these margins are situated minute styles, about three times as long as broad, separated by a brief interval, in which median portion the plate is very thin with margin angulate emarginate at slightly less than ninety degrees.

Body and limbs immaculate, pale yellowish brown, probably pale green in life, as is indicated by the presence of a few minute irregular green patches. Eyes blackish chestnut brown. Tegmina and wings hyaline, iridescent, almost clear, showing an exceedingly faint tinge of yellowish brown. Humeral vein and both median and discoidal veins, as far as the colorless stigma, purplish vinaceous.

Length of body 18.5, length of pronotum 5, length of pronotal collar 1.8, greatest width of pronotum 1.7, length of tegmen 14.7, width of tegminal marginal field .8, length of wing 13.7, length of cephalic femur 5.3, length of caudal metatarsus 4 mm.

5TH GROUP, STENOMANTES.

***Stenomantis novae-guineae* (Haan).**

1842. *M[antis] (Mantis) novae-guineae* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 76, pl. XVII, fig. 3. [♀, New Guinea.]

Fakfak, Dutch New Guinea, 1 ♀.

The peculiar, half-atrophied organs of flight and evenly swollen supra-coxal expansion with deep sulci latero-cephalad are striking features in this long and very slender insect.

Haan's figure is not as good as is usual in that work, the color pattern and contour being indistinct and particularly that of the supra-coxal expansion being apparently underestimated.

The tegmina are glassy, heavily suffused with blackish mars violet in the present specimen. Length of body 45, length of pronotum 17.4, greatest width of pronotum 3.1, least width of shaft of pronotum 1.2, length of tegmen 15.3, width of tegminal marginal field 1.2, length of caudal femur 17.8 mm.

IV. AMELINÆ.

2D GROUP, GONYPETÆ.

***Amantis reticulata* (Haan).**

1842. *M[antis] (Oxyptilus) reticulata* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 87, pl. XVII, fig. 9. [♂, ♀; Krawang, [Java].]

1915. *A[mantis] gestri* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVI, p. 154. [♂; Si-Rambe and Pangherang-Pisang, Sumatra.]

Though a meagre four-line description alone is given for *gestri* Giglio-Tos, it is sufficient to show that the features of difference are quite inadequate to warrant nominal recognition of any kind. The present series shows that the cephalic metatarsi in this species are entirely dark or dark only at the distal extremities, this a feature of individual variation, the intensive dark condition occurring, however, more often in the male sex.

Kelantan, Siam, 1 ♀.

Island of Penang, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 2 ♂.

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 2 ♂, 3 ♀.

Palabuan, southern Java, (from H. Fruhstorfer), 1 ♀.

Labuan Island, British North Borneo, 1 ♂, 2 ♀.

We find that in this species, genotype of *Amantis* by original designation, the cephalic femora have five ventro-external spines

(including the minute genicular spine), the cephalic tibiae ten ventro-external spines; Giglio-Tos gives nine spines for the ventro-external margin of the cephalic tibiae in his generic diagnosis.

Amantis maculata (Shiraki).

1911. *Gonypeta maculata* Shiraki,²¹ Annot. Zool. Japonensis, VII, p. 318. [♂, ♀; Shizuoka, Japan; Taihoku and Taipin, Formosa.]

Koonnaniu, Formosa, September 24, 1906, 1 ♀.

The present species is clearly a depauperate derivative from the same stock as *A. reticulata*. In *maculata* the cephalic tibiae have the ventro-external margins armed with eleven spines.

Amantis aeta²² new species. (Plate I, figure 7 and plate II, figure 9.)

This species is one of the least distinctively marked forms of the genus. Except for a dark brown suffusion distad on the ventral surface of the cephalic femora, the body and limbs show no striking markings, only in the female do less decided maculae of dark brown occur as well ventro-distad on the internal faces of the cephalic coxae and at the unguicular sulcus of the cephalic femora.

The species furthermore apparently differs from all others in having the tegmina and wings immaculate, clear hyaline in the males; hyaline but very faintly tinged with yellowish brown in the females, this much stronger in the marginal field of the tegmina and appearing distad as a succession of small flecks on the costal margin of the wings, with stigma colorless in both sexes.

TYPE.—♂; Mount Banahao, Island of Luzon, Philippine Islands. (From C. F. Baker.) [Hebard Collection Type No. 520.]

Size slightly larger, form somewhat more slender, with tegmina and wings more elongate than in the genotype, *A. reticulata*. Head generally as in that species, with occiput lacking sulci and weakly convex in transverse dorsal outline, differing from *reticulata* in having the triangle formed by the ocelli slightly broader than high and in having the facial scutellum broader, about three-fifths as high as greatest width. Antennae ciliate. Pronotum very similar to that of *reticulata*, but appreciably more slender, with narrowing of supra-coxal expansion cephalad not as decided; medio-longitudinally very weakly sulcate with a very feeble carina indicated on shaft as in *reticulata*, supra-coxal expansion and transverse supra-

²¹ We are unable to determine whether Shiraki's references are to actual publications.

"*Gonipeta maculata* Shiraki, Matsumura, 1907, Ekichiu-Mokuroku.

"*Gonipeta nawai* Shiraki, 1908, Konchiusekai."

²² The *Aetas*, or *Negritos*, are the aborigines of the Philippines.

coxal sulcus decided, but not as decided as in that species; shaft slightly less than one and one-half times as long as neck; lateral margins of pronotum lamellate and microscopically denticulate, these denticulations the bases of minute hairs as in *reticulata*. Tegmina and wings with venation and costal margins ciliate as in *reticulata*, tegmina broadening distinctly distad. Supra-anal plate roughly triangular, length less than half basal width, apex broadly rounded. Cerci small, slender, with joints bead-like, tapering to acute apex. Subgenital plate with lateral margins weakly convex convergent to styles, which are similar, slender, cylindrical, about four times as long as wide, separated by an interval equalling the length of one of them, the margin of which is transverse. Limbs as in *reticulata*. Cephalic coxæ unarmed, with mere traces of denticulation. Cephalic femora heavy, with dorsal margin straight, unarmed, unguicular sulcus two-fifths distance from base to apex; four discoidal spines, of which the first is minute; four heavy spines on ventro-external margin, with minute blunt projections on ventral face, a few of which are situated between the more distal of these spines, and with an additional small spine on each genicular lobe; spines of ventro-internal margin showing the following formula $\text{I I I I I I I I I I}$, of the longer of which the first and last are decidedly more elongate than the others. Cephalic tibiae with ventral margins bearing (nine to ten) external and (eleven to twelve) internal, rather heavy spines, which increase regularly and gradually in length distad. Caudal metatarsus approximately one and one-half times length of succeeding tarsal joints.

Allotype.—♀; same data as type. [Hebard Collection.]

Similar to the male, differing in the following features: Size larger, form slightly more robust. Ocelli proportionately not as large. Facial scutellum more transverse, height very slightly more than half basal width.²³ Cephalic coxæ with minute, microscopic denticulations, the bases of hairs. Cephalic femora with denticulations of ventral surface heavier. Supra-anal plate short, triangular in general outline, reaching to base of valves of subgenital plate, dorsal surface convex mesad, angulate concave along margins. Subgenital plate as in this sex of *reticulata*.

Both sexes yellowish brown in general coloration.²⁴ Male immaculate, except for a dark brown suffusion ventro-distad on the

²³ The dorsal margin of the facial scutellum is seen in the series to vary from very weakly convex, as in *reticulata*, to very broadly obtuse-angulate.

²⁴ Probably very pale green in life, as is indicated in several specimens by small areas where the chlorophyll has settled in drying.

cephalic femora, which spreads from the ventral surface over the sides of the adjacent genicular lobes, and cephalic metatarsus also suffused at distal extremity with dark brown. Tegmina and wings transparent, moderately iridescent, clear hyaline. Three of the four males from Mount Makiling have the facial scutellum suffused with dark vinaceous.

The female, in addition to the dark brown suffusion for the male, has the cephalic coxæ ventro-distad showing a large dark brown suffusion, a small similar suffusion on the distal margin of the unguicular sulcus and traces of the same on the external genicular lobes of the cephalic femora and on the cephalic tibiae mesad on each side and at the base of the metatarsus. The tegminal and wing coloration is described for this sex in the introduction to the species.

We would note that, except for the heavy dark marking distad on the ventral face of the cephalic femora, all of the darker suffusions found in the sexes of this species probably disappear completely in individuals of recessive coloration.

Measurements (in millimeters).

	Length of body.	Length of pronotum.	Width of pronotum.	Length of tegmen.	Greatest (distal) width of tegmen.
♂					
Mt. Banahao, <i>type</i>	16.3	3.8	1.9	15.7	4.3
Mt. Makiling, <i>paratype</i> ..	16.	3.7	1.9	15.3	4.2
Davao, <i>paratype</i>	15.3	3.3	1.7	13.7	4.
Davao, <i>paratype</i>	15.8	3.7	1.9	14.8	4.1
Zamboanga, <i>paratype</i>	16.3	3.8	1.9	14.7	4.3
♀					
Mt. Banahao, <i>allotype</i>	19	4.2	2.4	17.7	5.2

In addition to the described pair, the following paratypes are before us:

Mount Makiling, Island of Luzon, Philippine Islands, (from C. F. Baker), 4 ♂.

Paete, Laguna, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♂.

Dapitan, Misamis, Island of Mindanao, Philippine Islands, (from C. F. Baker), 1 ♂.

Davao, Davao, Island of Mindanao, Philippine Islands, (from C. F. Baker), 2 ♂.

Zamboanga, Zamboanga, Island of Mindanao, Philippine Islands, (from C. F. Baker), 1 ♂.

Amantis basilana new species. (Plate I, figures 8 and 9.)

This species is closely related to *A. aeta* here described, differing in the proportionately slightly broader head, with distinctly more transverse facial scutellum, slightly more proximal unguicular sulcus, more decided green coloration²² and distinctly though delicately marked pronotum and cephalic tibiae but immaculate cephalic femora.

Type.—♂; Island of Basilan, Zamboanga District, Philippine Islands. (From C. F. Baker.) [Hebard Collection Type No. 521.]

Compared with the male of *aeta*, this individual is seen to differ in the following characters, as well as in important features of coloration. Head proportionately distinctly broader. Ocelli smaller and arranged in a much more transverse triangle, almost twice as broad as high. Facial scutellum with height very slightly less than half basal width, dorsal margin weakly convex. Pronotum very similar to that of *aeta*, except that the medio-longitudinal sulcation is weakly indicated only at the supra-coxal expansion, the feeble carina of the shaft obsolete. Tegmina and wings as in that species, except that the tegmina widen very slightly distad, less so than in *aeta*. Genitalia damaged. Armament of femora and tibiae as described for *aeta*. Caudal metatarsus as in that species.²³

Allotype.—♀; same data as type. [Hebard Collection.]

Compared with the female of *aeta*, this specimen is found to agree closely, differing in the following respects, as well as in distinctive features of coloration. Head proportionately distinctly broader. Ocelli smaller and arranged in a much more transverse triangle, fully twice as broad as high. Facial scutellum with height about two-fifths basal width, dorsal margin transverse, scarcely convex.

Both sexes oriental green in general coloration, the specimens at hand with body faded to yellowish brown. Pronotum with a very narrow but sharply defined medio-longitudinal black line on shaft, extending from base of shaft to near the transverse supra-coxal sulcus, with a minute linear parallel mark of the same color on each side near the caudal margin of the shaft. Cephalic tibiae yellowish, with a large suffusion of blackish brown mesad on the external and dorsal faces and a fleck of the same color at the base

²² The green in these dried specimens is pronounced, though they have evidently faded considerably in drying from the living coloration.

²³ Missing in the type, these proportions shown by a paratypic female.

of the metatarsus. Cephalic metatarsi with a distal suffusion of blackish brown and, in the male, washed with this color mesad. Genicular areas of median and caudal femora narrowly blackish brown. Tegmina and wings transparent, moderately iridescent, hyaline, tinged weakly but distinctly with oriental green. Stigma of general tegminal coloration.

The paratypic female at hand shows a recessive type of coloration in having the cephalic tibiae with only traces of the two brown suffusions.

Measurements (in millimeters)

	Length of body.	Length of pronotum.	Width of pronotum.	Length of tegmen.	Greatest (distal) width of tegmen.
♂ Island of Basilan, <i>type</i>	15	3.8	1.8	13.4	3.5
♀ Island of Basilan, <i>allotype</i> . . .	18.7	4.8	2.3	16.9	4
Island of Basilan, <i>paratype</i> . .	17.9	4.4	2.2	16.3	4

The single paratypic female at hand bears the same data as the type and allotype.

Gonypeta borneana Giglio-Tos.

1915. *G[onypeta] borneana* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVI, p. 155. [♂, Borneo.]

Labuan Island, British North Borneo, 2♂.

The very dark coloration and rough surface are striking features in the present species.

V. COMPSOMANTINÆ

1ST GROUP, COMPSOMANTES.

Compsomantis semirufula (Westwood).

1889. *Hapalomantis semirufula* Westwood, Rev. Ins. Fam. Mantidarum, p. 37, pl. XIII, fig. 8, pl. I, fig. 1. [♂, ♀; Sarawak, Borneo.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂.

Males of the present species might easily be mistaken, at first glance, for representatives of the genus *Amantis* Giglio-Tos. Closer examination, however, shows the pronotum to be of an entirely different type, and the species to be, in fact, very widely separated from that genus. The superficial similarity of males of these species is even greater than that found between males of *Opsomantis tumidiceps* and those of *Amantis*, as in males of *semirufula* a weak but distinct lateral concavity of the pronotal shaft occurs.

In the male at hand the ocelli are well developed and approximate, the facial scutellum about one-third as high as its basal width,

with dorsal margin oblique and poorly defined laterad, transverse and carinate between the antennal sockets. The dark brown on the internal face of the cephalic femora is more diffuse and blurred than in Westwood's figure. The caudal metatarsus is as long as the combined length of the three succeeding joints. The genitalia are much like those of *Opsomantis tumidiceps*, except that the supra-anal plate is slightly less produced, the styles of the subgenital plate longer, fully five times as long as the greatest width, separated by a distance equal to four-fifths the length of one of the styles.

Length of body 24, length of pronotum 4.8, greatest width of pronotum 2.9, length of tegmen 21, width of tegminal marginal field 1.1, length of caudal femur 6.8, length of caudal metatarsus 2.1 mm.

***Opsomantis tumidiceps* (Bolivar).**

1890. *Compsomantis tumidiceps* Bolivar, Ann. Soc. Espanola Hist. Nat., XIX, p. 303. [♀; Dolores, Philippine Islands.]

Mount Makiling, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♂.

Like *Compsomantis semirufula*, this species might, at first glance, be mistaken for a member of the genus *Amantis*, but it is readily distinguished by a number of distinctive characters.

In the male before us we note that the ocelli are minute and rather widely separated, the facial scutellum distinctly less than half as high as its basal width, with dorsal margin weakly convex and showing slight irregularities. The limbs are all spotted and dotted with dark brown on both internal and external faces, a particularly large dot being situated on the internal face of the cephalic femur at the distal extremity of the unguitractor sulcus. The pronotum expands evenly to the portion of greatest width, the lateral margins curving evenly thence to the cephalic extremity, with no trace of concavity anywhere, the margins are entire, without trace of denticulation. The caudal metatarsus is scarcely longer than the combined length of the two succeeding joints. The supra-anal plate is evenly rounded, its length slightly less than half its proximal width. The subgenital plate has the lateral portions narrowly turned dorsad, the lateral margins straight convergent; the styles, situated at the narrow extremity and separated by a distance little over the width of one of these, proportionately large, flattened cylindrical, as long as the supra-anal plate, four times as long as the greatest width, with apices rounded.

Length of body 18.3, length of pronotum 5, greatest width of pronotum 2.3, length of tegmen 10, width of tegminal marginal field .9, length of caudal femur 5.3, length of caudal metatarsus 1.5 mm.

IX. THESPINÆ.²⁷

1ST GROUP, EUCHOMENELLÆ.

Euchomenella heteroptera (Haan).

1842. *Mantis* [*Mantis*] *heteroptera* Haan,²⁸ in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 78, pl. XVIII, fig. 1. [♂; Banjermassin, (Borneo); Java; Tondano, Celebes.]

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♂.

The present specimen agrees exactly with Haan's figure. We would note that the markings of the triannulate cephalic femora are exactly the same on the external and internal faces and that the wings are decidedly iridescent.

Euchomenella molucarum (Saussure).

1872. *E[uchomena]* *molucarum* Saussure, Mélang. Orth., II, p. 27. [♂, Moluccas.]

1895. *Euchomena molucarum* Saussure and Zehntner, in Grandidier, Hist. Nat. Madagascar, XXIII, p. 179. [♀, Java.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂.

This specimen agrees perfectly as to pronotal size and expansion with Saussure's figure, but not with the dimensions given in his description for this part. Compared with the male of *E. heteroptera* before us, the present insect is seen to differ in its smaller size, weakly maculate pronotum and tegmina,²⁹ cephalic tibiae which are as dark as the pronotum, slightly blackened internally at their extremities and cephalic femora which are as dark externally, with a few irregular areas of paler shade toward the ventral margin, but which internally are brownish buff, mottled with dark brown proximad, heavily mesad, with a broad blackish annulus meso-distad, succeeded by a narrow pregenicular blackish annulus.

²⁷ This name falls, as *Thespis*, properly defined, is a member of the group Musonixæ, which we believe best assigned to the subfamily Iridopteryginæ (not as understood by Giglio-Tos). We are not satisfied that this ninth division of Giglio-Tos is homogeneous or that it is worthy of recognition as a subfamily. We consequently do not propose a new name to take the place of the Thespinæ of Giglio-Tos.

²⁸ The female described and figured as this species, p. 78, pl. XVIII, fig. 2, represents a different species.

²⁹ The tegmina are well described by Saussure as "Membraneux, d'un brun-ferrugineux nuageux, marbrés de taches plus hyalines."

TAGALOMANTIS¹⁰ new genus. (Plate I, figure 10.)

We place in this genus the single species described by Saussure as *Euchomena manillensis* and referred by Giglio-Tos, apparently without having material for comparison, to his genus *Euchomenella*. To that genus nearest affinity is shown, *Tagalomantis* differing in the following features:

Form much less attenuate, slender. Eyes smaller and not remarkably protuberant. Pronotum with medio-longitudinal carina very weak. Limbs slender, but not as exceedingly slender as in *Euchomenella*. Cephalic femora with four discoidal spines, of which the third is very elongate, but not proportionately as extremely elongate as in *Euchomenella*. Ventro-external margin of cephalic femora armed with four elongate spines and one small spine on genicular lobe; ventro-internal margin showing the following spine formula IIIIIIIIIIIIII (for *Euchomenella* IIIIIIIIIIIIII). Cephalic tibiae with ventro-external margin armed, except for a brief distance proximad, with twelve spines, which increase gradually in size distad, the proximal spines very small.

Tagalomantis manillensis (Saussure).

1870. *E[uchomena] manillensis* Saussure, Mélang. Orth., I, p. 194, pl. VI, fig. 44. [♂; Manila, [Philippine Islands].]

Los Banos, Laguna, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♂.

This specimen is apparently slightly smaller than the type, but agrees fully in all important features with Saussure's description.

We would note that the limbs are pale brown, the cephalic coxæ showing, on their external surfaces, two slightly paler indistinct transverse bands and having their apices suffused with dark brown internally. In the present specimen the cephalic femora have the discoidal spines and the longer spines of the ventro-internal margin dark brown. Length of body 50, length of pronotum 18.7, length of collar 3.8, greatest width of pronotum 2.6, length of tegmen 27.8, width of tegminal marginal field 1.8, length of cephalic femur 11 mm.

IX. OLIGONICINÆ.

2D GROUP, HAANIAE.

Haania lobiceps (Haan).

1842. *M[antis] (Oxyptilus) lobiceps* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 85, pl. XVII, figs. 4 and 5. [Juv. and ♀ (nec ♀ and ♂); Padang, [Sumatra]; Krawang, [Java].]

¹⁰ The Ta-Gala are the most civilized native race of the Philippines.

Sandakan, British North Borneo, (from C. F. Baker), 1 ♀.

Giglio-Tos has recently cleared away the confusion surrounding this very remarkable little species.²¹

XVI. CALIRIDINÆ.

1ST GROUP, CALIRIDES.

Caliris masoni (Westwood).

1889. *Iris masoni* Westwood, Rev. Ins. Fam. Mantidarum, p. 32, pl. I, fig. 6. [♀, India.]

Khasia Hills, Assam (?), 1 ♀.

From comparison with the female of *C. elegans* Giglio-Tos, before us, we believe that either one exceedingly plastic species may be represented, or that *elegans* may prove to be a depauperate race of *masoni*. Additional material is needed to solve this problem.

The present specimen is larger than the measurements given by Westwood, almost the exact size of his figure. It has the marking of the radiate field more extensive and more striate caudad.

Length of body 40., length of pronotum 11.3, greatest pronotal width 4.8, least pronotal width 3., length of tegmen 22.7, width of tegminal marginal field 2.1, length of cephalic femur 12.4 mm.

Caliris elegans Giglio Tos.

1915. *C[aliris] elegans* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVI, p. 82. [♀; Deli, Sumatra.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂, 1 ♀.

We find the present female smaller than the type, even smaller than the measurements given by Giglio-Tos for his *C. elegans* from Sumatra. In the present female, however, the distal subcallous areas of the tegmina and the beautiful markings of the wings are as shown by Westwood's generally excellent figure. As to the distal obliquity of the humeral and median veins described for *elegans*, the same is true for the present female, and we believe will be found the same in the type of *masoni*, the figure being probably inexact in this feature.

The male sex being unknown for the genus and species, we would remark the following features:

General form similar to but more slender than that of female, armament of cephalic limbs exactly the same. Ocelli slightly larger. Facial scutellum generally similar to that of female, but very slightly broader, dorsal margin acute angulate mesad. Tegmina and wings

²¹ Bull. Soc. Ent. Italiana, XLVI, p. 198, (1915).

narrower than in female, but with similar venation; coloration transparent, with a very weak greenish tinge, veins very pale greenish. Subopaque or subcallous areas of tegmina and striking markings of wings not present in this sex. Supra-anal plate strongly transverse, length hardly one-third basal width; lateral margins nearly straight and strongly convergent from above cercal bases to broadly truncate apex. Subgenital plate flattened scoop-shaped, lateral margins weakly convex convergent, rounding distad into the broadly convex apex; dextral portion elevated dorsad from base of cercus to dextral style in a low ridge with dorsal margin broadly convex. Styles minute, simple, cylindrical, each about three times as long as wide, separated by a distance equalling about two-fifths the length of the style.

Though so utterly different in tegminal and wing coloration, the sexes of this species are easily associated by the similarity of cephalic and pronotal form and limb armament.

Length of body, ♂ 26.2, ♀ 30; length of pronotum, ♂ 6.8, ♀ 7.9; greatest pronotal width, ♂ 2.9, ♀ 3.5; least pronotal width, ♂ 2.1, ♀ 2.7; length of tegmen, ♂ 18, ♀ 17.3; width of tegminal marginal field, ♂ 1.6, ♀ 1.9; length of cephalic femur, ♂ 7.2, ♀ 9 mm.

***Gilda suavis* Giglio-Tos.**

1915. *G[ilda] suavis* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVI, p. 85. [♀; Limbang, Borneo.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♀.

The female sex of this species is even more beautiful than that of *Caliris masoni*. The present specimen is a trifle smaller than the type, agreeing fully in all details of coloration.

We would note that, in the material at hand, the cephalic tibiae have the ventro-internal margin supplied with thirteen spines in *Gilda* and with fourteen in *Caliris*, not including the terminal claw. This claw was either counted by Giglio-Tos for *Caliris*, or his material of that genus shows one more spine on the margin in question.

In *Gilda* the pronotum is longer, with shaft proportionately more slender and supra-coxal expansion much broader and consequently very much more conspicuous than in *Caliris*. In the present female the pronotum shows the following dimensions: length 13.3, greatest width 4, least width 1.8 mm.

3D GROUP, LEPTOMANTES.

***Leptomantis albella* (Burmeister).**

1838. *M[antis] albella* Burmeister, Handb. Ent., II, Abth. II, pt. I, p. 533. [Java.]

1915. *Leptomantis sumatrana* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVI, p. 88. [♂, Sumatra.]

After careful consideration of the literature and the material of this genus before us, we feel fully justified in placing *sumatrana* Giglio-Tos in synonymy. A possibility exists that the name should be placed under *L. fragilis* (Westwood), but due to the inadequacy of the original three-line description of *sumatrana*, this can be determined definitely only by examination of the type or further knowledge gleaned from Sumatran material.

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♂, 2 ♀.

Samarang, Java, November, 1909, (E. Jacobson), 1 ♂, [Academy of Natural Sciences of Philadelphia].

It is clear that the species of the genus are closely related, and particularly *albella* and *fragilis*. When compared with *fragilis*, the present insect is seen to differ in the male sex as follows. Interrupted dark line margining pronotum and mesal pair of dots normally very weakly indicated, in discolored specimens sometimes obsolete.²² Tegmina wholly immaculate. Supra-anal plate triangular with apex rounded, decidedly shorter than proximal width. Cerci tapering distad to slender apices.

Unfortunately lack of female material of *fragilis* prevents comparison for that sex. Females of *albella* are readily separable from those of *L. lactea* (Saussure) by the distinctly narrower marginal field of the tegmina (.8 mm. in width), while those before us are smaller than the female of *lactea* at hand (length of pronotum 11.4 and 12 mm.) with tegmina very weakly milky, except latero-proximal where they are weakly milky, in marginal field where they are translucent, milky and distal portions of marginal fields of tegmina and wings where they are buffy and almost opaque.²³

***Leptomantis fragilis* (Westwood).**

1889. *Musonia fragilis* Westwood, Rev. Ins. Fam. Mantidarum, p. 31. [[♂]; Sarawak, Borneo.]

1889. *Musonia bilineata* Westwood, Rev. Ins. Fam. Mantidarum, p. 32. [[♀]; Sarawak, Borneo.]

It is extremely probable that Westwood described sexes as indicated in the above synonymy. The male was apparently a discolored specimen, as the usual striking features of pronotal coloration are not mentioned in the description.

²² Burmeister's type was in such condition, or this feature was either naturally obsolete or wholly overlooked.

²³ Compare Saussure's comments on a Javanese female, at the time he placed his *lactea* under *albella*, Mélang. Orth., II, p. 72, (1872).

Giglio-Tos' reason for assigning *bilineata* to synonymy under *lactea* and then describing a new species, *sumatrana*, is certainly not clear.

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂.

Labuan Island, British North Borneo, 3 ♂.

When compared with *albella*, males of *fragilis* are seen to agree closely, differing from those of that species only as follows. Interrupted dark line margining pronotum and mesal pair of dots normally well defined, particularly on the collar.³⁴ Tegmina and wings distad with outer portion of marginal field almost opaque and strikingly buffy or reddish. Supra-anal plate triangular with apex acute, length slightly greater than proximal width. Cerci shorter, distal joint flattened with apex rounded, slightly broader than the preceding joints.

We regret that no females of this species are before us.

***Leptomantis lactea* (Saussure).**

1870. *M[iopteryx] lactea* Saussure, Mélang. Orth., I, p. 274. [♀; Manila, Philippine Islands.]

Mount Makiling, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♀.

The specimen at hand has the body much discolored and shows no dark markings on the pronotum, as did specimens in Saussure's series, other than the type. Such a condition would appear to occur also in *albella* and *fragilis*. The specimen under consideration is slightly larger than Saussure's type, in other respects agreeing fully. The tegmina and wings are weakly milky, the outer portion of the marginal fields distad being slightly more so.³⁵ When compared with females of *albella*, the present female is seen to be larger with pronotum distinctly heavier, its lateral margins minutely but distinctly denticulate, not smooth as in that species. The measurements of this specimen are: length of body 35, length of pronotum 13, least width of pronotum 1.3, length of tegmen 21, width of tegmental marginal field 1.2, length of exposed portion of wings when at rest 4.7, length of cephalic femur 7.8 mm.

***Leptomantis tonkinæ* new species. (Plate I, figures 11 and 12.)**

This species is apparently nearest *L. indica* Giglio-Tos, but so poorly is that species characterized that the degree of affinity can not be satisfactorily determined.

³⁴ Apparently these markings are sometimes absent, possibly due to discoloration. Westwood makes no mention of this feature in describing the type of *fragilis*, but describes it in full for the type of *bilineata*.

³⁵ See additional remarks under *albella*.

The marking of the pronotum and cephalic coxæ are distinctive features in *tonkinæ*. It is nearer *lactea* than *albella* or *fragilis*, agreeing with the female of *lactea* before us in the heavier pronotum with lateral margins serrulate, wider marginal field of the tegmina and heavily milky tegmina and wings. The pronotum is, indeed, slightly heavier and the tegmina and wings very much more heavily milky than in *lactea*.

TYPE.—♀; Than-Moi, Tonkin. June and July. (From H. Fruhstorfer.) [Hebard Collection Type No. 523.]

Size large for the genus, form very slender but not as slender as in females of *albella*. Summit of vertex raised above dorsal margins of eyes a brief distance, straight, transverse to brief areas on each side adjacent to eyes, which are convex and project very slightly. Ocelli very small, well separated, forming a triangle nearly twice as broad as high. Facial scutellum poorly defined, strongly transverse, dorsal margin convex in median portion. Pronotum very elongate and slender but slightly heavier than in this sex of *lactea*, decidedly heavier than in females of *albella*, lateral margins minutely serrulate, supra-coxal expansion very weak, transverse sulcus distinct. Tegmina with venation as characteristic for genus, falling considerably short of apices of wings (by 5 mm.), marginal field comparatively broad (1.6 mm. in width). Cerci hairy, tapering to acute apices. Supra-anal plate can not be examined without injury to type. Cephalic femora with four discoidal spines, of which the first two are rather closely placed and nearly opposite each other transversely on the ventral surface, the first being on the internal margin just before the unguicular sulcus;* ventro-external margin with four elongate spines and all genicular lobes with a small spine; ventro-internal margin with the following formula I I I I I I I I I I, of which all the longer spines in the alternating series slant inward and distad to some degree. Cephalic tibiae with ventro-external margin armed with seven spines, of which the first is placed at a distance from the second, this equalling twice the interval between the second and third, the remaining intervals brief; first, third, fourth and sixth spines small, second and fifth of about double that size and length, seventh and apical spine decidedly the heaviest and longest. Caudal metatarsus twice length of succeeding joints.

* On one limb a single very small spine is found on the ventro-internal margin before the first discoidal spine. This is apparently an abnormality.

General coloration apparently pale green in life (the head, pronotum and caudal limbs have faded to yellowish brown). Pronotum with a pair of delicate lines, formed by a succession of blackish brown dots, margining the medio-longitudinal carina of the shaft, with more extensive blackish brown maculations forming a distinctive pattern on supra-coxal expansion and neck (see Plate I, figure 11). Cephalic coxæ with ventral surface narrowly bordered for a brief distance distad along internal margin with blackish brown and with a fleck of the same color meso-distad. Body and limbs elsewhere entirely immaculate. Tegmina and wings³⁷ heavily milky, so that when at rest they are actually transparent only distad, in other portions almost opaque; veinlets pale green; marginal fields distad, in portion between marginal and mediastine veins, opaque, milky.

Length of body 35, length of pronotum 12.2, greatest width of pronotum 2.2, least width of pronotal shaft 1.7, length of tegmen 23, width of tegminal marginal field 1.6, length of cephalic femur 8.1, length of caudal femur 9, length of caudal metatarsus 2.4 mm.

The type of this striking species is unique.

AETAELLA³⁸ new genus.

The present genus is very closely related to *Leptomantis* Giglio-Tos.³⁹ We find these genera to agree closely, except in characters of the armament of the cephalic femora and tibiae. In both genera the spines of these margins are strongly developed, the number and proportions constant;⁴⁰ for the cephalic femora the discoidal spines are four in number, of which the first two are rather closely placed and nearly opposite each other transversely on the ventral surface, the first being on the internal margin just before the unguicular sulcus; the ventro-external margin with four elongate spines and all genicular lobes with a minute but elongate spine.

Genus monotypic. *Genotype*.—*Aetaella bakeri* here described.

³⁷ The form of the tegmina and wings when at rest, with apices of the latter considerably surpassing those of the former, and the distal, marginal, more strongly colored areas along the costal margin, gives the species before us of the genera *Xanthomantis*, *Polyacanthopus*, *Leptomantis* and *Aetaella* a distinctive and rather similar general facies, suggesting that shown by species of the Neuropteroid genus *Mantispa*.

³⁸ From *Aeta*+*ella*. The *Aetas*, or *Negritos*, are the aborigines of the Philippines.

³⁹ Bull. Soc. Ent. Italiana, XLVI, p. 87, (1915).

⁴⁰ Except for the smallest distal spines of the ventro-internal margin of the cephalic femora, which in *Aetaella* individually vary from three to five.

The features which separate *Aetaella* from *Leptomantis* are given below for the two genera.

In *Leptomantis* the ventro-internal margin of the cephalic femora shows the following formula, I I I I I I I I I I. The cephalic tibiae have the ventro-external margin armed with seven spines, the first separated a considerable distance from the second, the second a lesser distance from the third, the others separated by very brief intervals. The first spine is elongate, the second much more so, the third and fourth of about the same length, shorter than the first, the fifth intermediate in length between the first and second, the sixth shorter, intermediate in length between the fourth and fifth, the seventh very elongate, it and the second the longest spines of the series. The cephalic tibiae have the ventro-internal margin armed with eleven to twelve spines.

In *Aetaella* the ventro-internal margin of the cephalic femora shows the following formula, I I I I I I I I I I I I I. The cephalic tibiae have the ventro-external margin armed with six spines, the placement similar to that in *Leptomantis*, except that the distal spines are not so closely placed. The first spine is elongate, the second more so, the third shorter than the first, the fourth as long as the first, the fifth as long as the third, the sixth slightly longer than the second. The cephalic tibiae have the ventro-internal margin armed with thirteen to fifteen spines.

We would note further that in *Aetaella* the tegmina do not widen distad as much as in *Leptomantis* and, in consequence, the oblique veins are not quite as widely separated.

Aetaella bakeri⁴¹ new species. (Plate I, figures 13 and 14.)

In general appearance and form this species agrees closely with *Leptomantis albella* (Burmeister). In addition to the striking differences of cephalic limb armament, the tegmina of this insect are seen to be somewhat narrower in both sexes, with oblique veins consequently slightly more approximate.

The males of *A. bakeri* have the moderately large ocelli arranged in a triangle slightly wider than high, while the males of *L. albella* have the slightly larger ocelli arranged in a triangle slightly higher than wide. In the females of both species the ocelli are greatly reduced and arranged in a triangle wider than high. The tegmina and wings are clear hyaline in *A. bakeri*, but show a slight milky suffusion in *L. albella*.

⁴¹ We take pleasure in naming this interesting Mantid in honor of Mr. C. F. Baker, through whose efforts a large portion of the material at present under consideration has been assembled.

TYPE.—♂; Mount Makiling, Island of Luzon, Philippine Islands. (From C. F. Baker.) [Hebard Collection Type No. 522.]

Size medium small, form extremely slender, as in *L. albella*. Head transverse, summit of occiput transverse and on a plane with dorsal margin of eyes, except briefly near the eyes, where, on each side, it is moderately produced and convex. Ocelli as described above. Facial scutellum strongly transverse, height one-fourth width, dorsal margin rather broadly convex. Pronotum very elongate and slender, margins unarmed, dorsal surface smooth, a trace of medio-longitudinal sulcation indicated in area of supra-coxal expansion, transverse sulcus there well defined, supra-coxal expansion feeble. The tegminal apices fall slightly short of the abdominal apex, the wing apices fall slightly beyond the abdominal apex; the venation of these organs is similar to that found in *L. albella*, the tegmina are, however, slightly narrower and are surpassed by the wings by a lesser distance. Supra-anal plate minute, length half basal width, lateral margins convergent to the broadly rounded apex. Cerci elongate, tapering to acute apices, each joint rounded with greatest width near distal extremity. Subgenital plate with lateral margins convergent only distad, styles slender and cylindrical, about four times as long as wide, separated by a distance equalling the length of one of the styles. Cephalic femora with unguicular sulcus mesad, with a circular concavity between the first two spines of the ventro-external margin, into which fits the apex of the terminal spine of the ventro-external margin of the cephalic tibia when these parts are flexed, ventral surface with a cluster of minute sharp teeth opposite the second spine of the ventro-external margin. Armament of limbs as given in generic diagnosis. Caudal metatarsus nearly twice as long as combined length of succeeding joints.

Allotype.—♀; same data as type. [Hebard Collection.]

Agrees with male in all but the following features. Size larger. Ocelli much smaller and arranged in a triangle which is considerably wider than high. Supra-anal plate with length slightly less than half basal width, triangular, with apex broadly rounded. Subgenital plate with valves of distal portion evenly convex dorsad and ventrad.

General coloration delicate green in life.⁴² Entire insect immaculate. Tegmina and wings transparent, iridescent, clear hyaline.⁴³

⁴² The majority of the specimens of the present series have faded to yellowish brown.

⁴³ In the specimens before us in which the coloration apparently shows the best preservation, these organs are faintly tinged with green, the veins green. In the others of the series all trace of green has disappeared, the veins being yellowish brown.

Measurements (in millimeters)

♂	Length of body.	Length of pronotum.	Greatest width of pronotum.	Length of tegmen.	Width of tegmen.
Mt. Makiling, <i>type</i>	27	9.2	1.6	16.3	3.4
Malinao, <i>paratype</i>	27.2	9.3	1.6	16.4	3.6
Dapitan, <i>paratype</i>		8.9	1.5	16	3.4
Sandakan, Borneo.....	25	8.6	1.4	13.6	
♀					
Mt. Makiling, <i>allotype</i> ..	31	11.2	1.7	18.4	3.9
Los Banos, <i>paratype</i>	31	11.2	1.7	18.3	3.8
Los Banos, <i>paratype</i>	33.5	11.4	1.8	18.4	3.8

In addition to the type and allotype, the following material is before us, of which we consider the Philippine specimens paratypic.

Mount Makiling, Island of Luzon, Philippine Islands, (from C. F. Baker), 2 ♂.

Malinao, Tayabas, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♂.

Los Banos, Laguna, Island of Luzon, Philippine Islands, (from C. F. Baker), 2 ♀.

Dapitan, Zamboanga, Island of Mindanao, Philippine Islands, (from C. F. Baker), 1 ♂.

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂.

XXI. DEROPLATINÆ.

1ST GROUP, DEROPLATES.

Deroplatys desiccata Westwood.

1839. *Deroplatys desiccata* Westwood, Mod. Classif. Ins., I, p. 430. [Malacca.]

Labuan Island, British North Borneo, 4 ♂, 1 ♀.

Sandakan, British North Borneo, (from C. F. Baker), 1 ♀.

Deroplatys truncata (Guérin).

1843. *Choeradodis truncata* Guérin, in Delessert, Souv. Voyage Inde, Hist. Nat., p. 65, pl. XV. [[♀]; Singapore, Malay Peninsula.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂, 1 ♀.

XXII. MANTINÆ.

2D GROUP, SPHODROPODÆ.

Sphodropoda tristis (Saussure).

1870. *M[antis] tristis* Saussure, Mélang. Orth., I, p. 241. [♀; Islands of Viti [= Fiji Islands].]

Townsville, Queensland, Australia, 1 ♀.

Queensland, Australia, 2 ♂.

This species is now known to have a wide distribution over the Australian continent.

Sphodropoda quinquedens (MacLeay).

1827. *Mantis quinquedens* MacLeay, King's Survey Intertrop. Coasts Australia, II, p. 454. [Northern and western coasts of Australia.]

Queensland, Australia, 1 ♀.

The striking sculpture and coloration of the internal faces of the cephalic femora, which bear four buffy, elevated, transverse lines on the otherwise glossy ochraceous-tawny surface, are distinctive features in this species.

11TH GROUP, MANTES.

Statilia maculata (Thunberg and Lundahl).

1784. *M[antis] maculata* Thunberg and Lundahl, Dissert. Ent. Novas Ins. Spec., pt. III, p. 61. [Japan.]

1912. *S[atilia] haanii* var. *hyalina* Giglio-Tos, Bull. Soc. Ent. Italiana, XLIII, p. 7. [Japan.]

We can not agree with Giglio-Tos in recognizing the species here considered as *S. haanii* (Saussure). Among the Japanese Mantidæ, Thunberg and Lundahl's description of *maculata* fits this species and this species only.⁴ Their statement "thorace alato spinuloso" we interpret to mean that the spinulæ along the lateral margins of the pronotum project outward, as indeed they do. Saussure's *haanii* has long, and properly, been placed in synonymy under *maculata*.

Giglio-Tos has proposed the name *hyalina* for a specimen evidently showing an extremely recessive coloration. We therefore place this name in the present synonymy as having no systematic value.

Khasia Hills, Assam, 1 ♀.

Labuan Island, British North Borneo, 4 ♂, 6 ♀.

Sandakan, British North Borneo, (from C. F. Baker), 2 ♂.

Obi Island, Moluccas, 2 ♂.

All of the specimens here recorded show the characteristic markings of the cephalic coxæ and femora. In the series the extremes of pronotal length are: ♂ 12.8 to 14.2, ♀ 14.8 to 17.3; the extremes of greatest pronotal width, ♂ 3.1 to 3.7, ♀ 4 to 4.9 mm.

Statilia nemoralis (Saussure).

1870. *Pseudomantis nemoralis* Saussure, Mitt. Schweizer Ent. Ges. III, p. 229. [♀; Manila, [Philippine Islands].]

⁴ A large Japanese series of the species, in the Academy and Hebard Collections, is before us.

Island of Basilan, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♂, 1 ♀.

Mt. Makiling, Island of Luzon, Philippine Islands, (from C. F. Baker), 2 ♂.

Los Banos, Laguna, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♂.

Society Islands, 1 ♂.

This species is very closely related to *maculata*. The specimens at hand are all smaller, with cephalic femora very slightly but appreciably more slender than any examples in the large series of *maculata* before us. In addition, all but one entirely lack a black transverse line bordering the unguicular sulcus distad.

The black markings of the cephalic coxæ and femora are shown by the present material to be extremely variable. In the Philippine specimens the cephalic coxæ are black proximad on their internal faces for a distance equalling about one-fourth their length, the adjacent portions of the prosternum dark, the femora without marking at the unguicular sulcus, with bases of ventro-internal spines maculate with black, the surface of the limb above these markings pale.

The Basilan male is marked as is characteristic for *maculata*, but with entire ventral surface of prosternum suffused. The Basilan female is a very dark individual, but shows the same black markings as the Philippine males; in this individual the pale area above the ventro-internal spines of the cephalic femora being very conspicuous and in sharp contrast with the dark general coloration.

The Society Islands male has the cephalic coxæ black proximad on their internal faces for a distance equal to about one-half their length, the prosternum immaculate, the femora with half of area proximad of unguicular sulcus black, with bases of ventro-internal spines blackish.

Measurements (in millimeters)

	Length of body.	Length of pronotum.	Greatest width of pronotum.	Length of tegmen.	Length of caudal femur.	Width of caudal
♂						
Island of Basilan.....	34.8	10.6	2.3	22.8	10.1	1.3
Los Banos, Luzon....	40.5	12.3	2.7	24.9	11.3	1.2
Mt. Makiling, Luzon..	36	9.9	2.4	21.7	8.8	1
Mt. Makiling, Luzon..	40.5	12.3	2.7	25.6	11.3	1.3
Society Islands.....	30.8	9.7	2.3	22.7	9.2	1.2
♀						
Island of Basilan.....	42.7	14.5	3.8	23.2	13.5	1.8
Samarang, Java ⁴⁸	38	11.8	3.2	29.2	11.7	1.8

⁴⁸ In the Academy collection. Recorded by Rehn, Notes Leyden Mus. XXXV, p. 123, (1912). The female from Goenong Soegi, Lampong, Sumatra, referred at that time to *memoralis*, we assign to *maculata*, as originally recorded by Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 704, (1903).

12TH GROUP, TENODERÆ.

Tenodera⁴⁶ *aridifolia* (Stoll).

1813. [*Mantis*] *aridifolia* Stoll, *Natuur. Afbeeld. Besch.* Spoken, etc., pp. 65, 78, pl. XXII, fig. 82. [East Indies.]

Khasia Hills, Assam, 1 ♀.

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♂, 1 ♀.

Labuan Island, British North Borneo, 1 ♂, 2 ♀.

Davao, Davao, Mindanao, (from C. F. Baker), 1 ♂.

Society Islands, 1 ♂.

The specimens from Labuan are decidedly larger than the others of the present series.

We would note that the proportionate difference between the length of the shaft (metazona) of the pronotum and the cephalic coxæ for the present species and *sinensis* (Saussure) is exaggerated in Giglio-Tos' key.⁴⁷ In both species the pronotal shaft is distinctly longer than the cephalic coxa, the degree averaging only slightly greater in *aridifolia*.

We find that *sinensis* is proportionately a heavier insect, with pronotum distinctly shorter and broader. In a large series of Japanese material of that species in the Philadelphia Collections, we find that the width of the tegminal marginal field varies in the females from 3.9 to 4.5 mm.

In the females of *aridifolia* at hand, the width of the tegminal marginal field is narrower, varying as follows: Khasia Hills, Assam, 3.8; Trong, Siam, 2.9 and 3.3; Singapore, Malay Peninsula, 2.7; Goenong Soegi, Sumatra, 2.6; Labuan, Borneo, 2.4 and 2.6 mm. This material would appear to indicate a gradual reduction in the width of this field in material of the present species from continental Asia eastward through the Malayan Regions.

⁴⁶ The type of *Paratenodera* Rehn is *sinensis*, as originally designated by that author (*Proc. Acad. Nat. Sci. Phila.*, 1903, p. 705, (1903)), not *aridifolia* as later designated by Giglio-Tos (*Bull. Soc. Ent. Italiana* XLIII, p. 33, (1911)). From the study of the considerable number of species now before us in the Philadelphia Collections, we believe that but one genus is represented in the regions under consideration and follow Giglio-Tos in placing *Paratenodera* Rehn in synonymy under *Tenodera* Burmeister, of which the genotype is *fasciata* (Olivier) = *attenuata* (Stoll).

Though *sinensis* Saussure and *attenuata* (Stoll) differ so widely in form and general appearance, *australasiæ* (Leach) is seen to be an almost intermediate type, while no combination of characters to divide the Asiatic species can be found, sufficient to warrant generic separation.

⁴⁷ *Bull. Soc. Ent. Italiana*, XLIII, n. 33, (1911).

Tenodera attenuata (Stoll).

1792. *Mantis fasciata* Olivier, Encycl. Méthod., VII, p. 640, No. 6. [[♂], "Surinam."]

1813. [*Mantis*] *attenuata* Stoll, Natuur. Abfeeld. Beschr. Spoken, etc., pp. 13, 79, pl. V, fig. 16. [[♂], "Surinam."]

We find Kirby, Giglio-Tos and others to be in error in using *fasciata* (Olivier) as the name for this species. This is due to the fact that the *Mantis fasciata* Olivier in question is preoccupied by *Mantis fasciata* Thunberg, 1815, and by *Mantis fasciata* Olivier, 1792, Encycl. Méthod., VII, p. 640, No. 4.

Samarang, Java, July and August, 1909, (E. Jacobson), 2 ♂,⁴⁸ [Academy of Natural Sciences of Philadelphia.]

Tenodera blanchardi Giglio-Tos.

1911. *T[enodera] blanchardi* Giglio-Tos, Bull. Soc. Ent. Italiana, XLIII, p. 46. [♂, ♀; Stephansort, German New Guinea; Bukana, Gulf of Huon, New Guinea; Ralum, Bismarck Archipelago; Cape York, Torres Strait, [Queensland, Australia]; Port Darwin, [North Australia]; Ternate [Gilolo Island, and Island of] Amboina].

Obi Island, Moluccas, 9 ♂, 9 ♀.

Moluccas, (Griole), 1 ♀, from Saussure, labelled *superstitiosa*, [Academy of Natural Sciences of Philadelphia.]

Amboina, 2 ♂, 2 ♀, [Academy of Natural Sciences of Philadelphia.]

Mesopteryx alata Saussure.

1870. *M[esopteryx] alata* Saussure, Mittheil. Schweizer Ent. Gesellsch., III, p. 235. [♀; Manila, [Philippine Islands].]

Los Banos, Laguna, Luzon, (from C. F. Baker), 1 ♂.

As the male sex of this interesting species was previously unknown, we note the following features. Lateral margins of pronotum, dorsad and ventrad, show a series of very minute black dots. Tegmina reach slightly beyond apex of fifth dorsal abdominal segment. Distal portion of abdomen damaged. Length of body 87, length of pronotum 29.4, length of pronotal shaft 24, greatest pronotal width 4, least width of pronotal shaft 3.8, length of tegmen 43.6, width of tegminal marginal field 2.7, length of cephalic femur 15.9, length of median femur 16.2, length of caudal femur 21.2 mm.

13TH GROUP, HIERODULÆ.

Giglio-Tos has divided this complex group into three categories: the first African, including *Sphodromantis* and its allies; the second Asiatic and Oriental, including *Hierodula* and its allies; the third

⁴⁸ Recorded by Rehn as *T. superstitiosa* (Fabricius), Notes from Leyden Mus., XXXV, p. 124, (1912).

Melanesian and Australian, including his new genus *Parhierodula* and its allies.

It is the last two categories with which we have particularly to deal and, from the material before us, we feel fully justified in repudiating the arrangement made by Giglio-Tos.

The insurmountable difficulty in that author's argument lies in the fact that, were we to accept the character of smoothness or serration of the costal margins of the tegmina as primarily important, we would give this feature far more weight than is its due. We consider this feature of probably a physiologic application and by no means as important for generic separation as the great pronotal expansion found in the forms which, in the past, were all assigned to *Rhombodera*. This different pronotal expansion is clearly a somatic character. It is found in the immature stages. The tegminal features are found in the adult condition only and for that reason we feel obliged to consider them of secondary value.⁴⁹

We therefore place *Parhierodula* Giglio-Tos under *Hierodula* Burmeister, and *Rhomboderula*⁵⁰ Giglio-Tos, described as a subgenus of *Parhierodula*, under *Rhombodera* Burmeister. These two units as recognized by Giglio-Tos, *Parhierodula* and *Rhomboderula*, may not even stand as subgenera, based only on the different character of the costal margins of the tegmina.

Using the same argument, when we consider the African species of the Hierodulæ, we find that Giglio-Tos' subgenus *Rhomboderella*, of the genus *Sphodromantis* Stål, represents a valid generic unit.

Though the relative values of the character of the tegminal margins or the pronotal development afford full justification for such action, the material at hand shows further necessity for the present adjustment. Several species before us, some with costal margins of the tegmina smooth, others with these margins serrulate, unquestionably belong not only to the same genus, but also to the same species group within the genus. The general facies and sum total of characters in these is much too close to be ascribable to convergence in two different genera, as Giglio-Tos, using his classification, would be forced to assume. Thus *Hierodula laevicollis* Saussure and *Hierodula sorongana* (Giglio-Tos) are species of close affinity,

⁴⁹ Indeed Giglio-Tos himself evidently was obliged at times to switch to this point of view, for otherwise he would have no grounds for erecting the related genus *Prigomantis*.

⁵⁰ We here select *Rhomboderula* [*Rhombodera*] *saussurei* (Kirby) as genotype of *Rhomboderula* Giglio-Tos. For a discussion of the species which Giglio-Tos assigned to his *Rhomboderula*, see page 00.

representing a group within the genus of more recent common ancestry. To this same group belongs *Hierodula obiensis*, described in the present paper. Here we have two species with costal margins of tegmina smooth and one (*sorongana*) with these margins distinctly serrulate. Again *Hierodula venosa* (Olivier) and *Hierodula vitrea* (Stoll) are referable to another similar group, though *venosa* has the costal margins of the tegmina smooth, *vitrea* showing these margins varying individually from very weakly to distinctly serrulate, as has been noted by Giglio-Tos. In this latter species we further see that the degree of serrulation of the tegminal margins is variable, even within a species unit.

In the majority of cases the Asiatic and Malayan forms have the tegmina with costal margins smooth, the Papuan and Australian forms having these margins serrulate,⁴¹ but this interesting feature, probably physiologic as we have stated, is by no means as absolute as one would infer from superficially considering Giglio-Tos' statements. Though these groups are geographically defined by Giglio-Tos, using Wallace's Line, examination of his specific assignments shows that six species referred to *Hierodula* (*sensu strictiore* of Giglio-Tos), considered by him to be an Oriental genus, occur only in the Australasian regions; five species referred by Giglio-Tos to his *Parhierodula*, which he considered to be a Papuan and Australian genus, occur only in the Asiatic and Oriental regions, while one species of each of his divisions occurs on both sides of Wallace's line.

The genus *Hierodula* is exceedingly large, but already a number of the species have been separated by Giglio-Tos into distinct and apparently valid genera: *Alalomantis*, *Hierodulella*, *Pnigomantis*, *Ephierodula*, *Camelomantis* and *Tisma*. It will probably also be found necessary to separate *Hierodula tamolana* (Brancsik) and its allies in a distinct genus. At present sufficient material is wanting for proper and definite comparative analysis and assignment of these.

HIERODULA Burmeister.

1838. *Hierodula* Burmeister, Handb. Ent., II, Abth. II, pt. I, p. 536.

1912. *Parhierodula* Giglio-Tos, Bull. Mus. Soc. Ent. Italiana, XLIII, p. 108.

⁴¹ Giglio-Tos takes this to mean that two distinct sources are represented, one Asiatic, the other Australasian. The probability is, in our opinion, that the Asiatic phylum is the original source, the other a derivative from it. This opinion is strengthened by the realization that the forms with tegminal margins serrulate reach much their greatest numerical abundance in Papua and in few cases is their distribution extended to Australia, while none are known peculiar to that continent.

Genotype, selected by Rehn.⁵²—*Hierodula* [*Mantis*] *membranacea* (Burmeister).

We regret, but feel obliged to say that Giglio-Tos' treatment of the *Hierodulæ* leaves much to be desired. That author has described eight genera and forty-six new species. The descriptions are deplorably brief, in some cases represented by a single short and wholly comparative sentence. The measurements omit all but the most essential proportions. Not a single figure is given. Not only are the major divisions faulty, but also the arrangement of the species, such as placing without comment, *Hierodula ovata*, clearly the female of *Hierodula laevicollis*, twenty-fourth and *laevicollis* thirty-fifth.

Finally we are disturbed by Giglio-Tos' conception of what constitutes a species. That author has described *Stagmomantis nordica* from Virginia and Baltimore, Maryland. After years of careful field work in that region we have proof positive that *Stagmomantis carolina* (Johansson) is the only Mantid which occurs there, *nordica* being based on merely an intensively colored phase of that species. Realizing this we are dismayed at the number of new species described from little known tropical regions, the descriptions giving differences which are so slight that we can but fear that a multitude of invalid species have been proposed.

The situation only shows the absolute necessity at the present time, of the specialist, working on a particular group of insects, to have a first hand knowledge of the forms in nature. It would appear that the most serious defects in Giglio-Tos' studies are due to the fact that that author has apparently had little or no preparation in the field for the task undertaken.

***Hierodula gracilicollis* Stål.**

1877. *H[ierodula] gracilicollis* Stål, Bih. till K. Svenska Vet. Akad. Handl., IV, No. 10, p. 58. [♀; Sarawak, [Borneo].]

1898. *H[ierodula] stigmata* Brunner, Abhandl. Senkenb. Naturforsch. Ges., XXIV, p. 214, pl. XVII, fig. 21. [♂; Kina Balu, [British North] Borneo.]

We believe Kirby correct in considering *stigmata* the same as *gracilicollis*, but are of the opinion that *Mantis similis* Giebel is best assigned to synonymy under *Hierodula venosa* (Olivier).

Labuan Island, British North Borneo, 2 ♂, 1 ♀.

These specimens are the most delicate and slender of any material now before us representing the genus *Hierodula* or its allies. The

⁵² Proc. Acad. Nat. Sci. Phila., 1903, p. 708, (1903).

female at hand differs from the type in being somewhat longer, with pronotal width slightly greater and tegmina slightly longer, in all other respects agreeing closely with the measurements given by Stål.

The following features are noted for the present material. Facial scutellum with lateral margins parallel, broader than high (σ 1.9 by 1.7, φ 2.8 by 2.7 mm.), showing two parallel vertical carinæ which are well defined, particularly ventrad, but show a brief subsidence, though no break, immediately below the median point. Cephalic coxæ with cephalic margin armed with small, somewhat irregularly placed, slender but blunted spines (eight to thirteen³³), with apices directed distad, those meso-distad being slightly the larger. Cephalic femora with base and apex of trochanter flecked with dark brown, a minute brown fleck at base of first discoidal spine, at base of first large spine beyond the unguicular sulcus and at bases of last two large spines of this series, these spines, as well as the third discoidal spine, blackish brown on their internal faces. All spines of cephalic femora and tibiæ black tipped. Each joint of cephalic tarsi flecked with brown distad. Pronotum with well developed but not closely placed marginal denticulations on collar and cephalic half of shaft, weaker in one male and in that specimen mainly indicated on collar. Tegmina with discoidal field transparent, hyaline in males, opaque in female, except mesad between veins, where they are translucent; stigma small (length 2.7 to 2.8 mm.), flecked with brown proximad and distad.

Measurements (in millimeters).

σ	Length of body.	Length of pronotum.	Greatest width of pronotum.	Least width of pronotum.	Length of tegmen.
Labuan Island, Borneo	55	16.2	4	2.2	41.1
Labuan Island, Borneo	56	17.6	4.2	2.3	44.8
φ					
Labuan Island, Borneo	62	21	5.6	3.1	34.2

The width of the marginal field of the tegmina in the males is 4 and 4.2, in the female 5 mm.

Hierodula vitrea (Stoll).

1813. [*Mantis*] *vitrea* Stoll, Nat. Afbeeld. Beschryv. Spookten, etc., pp. 15, 77, pl. V, fig. 19. [[σ], "Surinam."]

³³ Interspaced with a few very small nodiform spines, so that the full count would be given as twelve to fourteen.

Batu Sangkar, Tanah Datar, Padangsche Bovenland, Sumatra, August and September, 1901, (Harrison and Hiller), 2 ♀, [Academy of Natural Sciences of Philadelphia].

Batavia, Java, 1885, 1 ♂ from Saussure, labelled *Hierodula hybrida* Burmeister, [Academy of Natural Sciences of Philadelphia].

Srondol, Samarang, Java, August, 1909, (E. Jacobson), 1 juv. ♂, [Academy of Natural Sciences of Philadelphia.]

We are by no means assured that Stoll's *vitrea* and Olivier's *venosa* do not represent sexes of one and the same species, but we do know that we have two distinct though closely allied species before us, to which we believe have been generally given in the literature the names we are using. So involved is the synonymy at present that we are strongly of the opinion that we here have to deal with an extremely plastic unit, comparable with *H. patellifera* Serville, and like it, the cause of much confusion in past literature. Consequently many features, usually considered of specific diagnostic value, will probably be found worthless for the species under consideration.

For this reason we feel that Giglio-Tos has shown decided temerity in describing *Hierodula vitreoides*, near *vitrea*, and *Parhierodula simbangana*, near *venosa*. Were these species adequately described, or figures given, their proper status might be determined. As it is, examination of the types and, if valid, redescription with figures will be necessary.

In the material here recorded the cephalic coxæ have the cephalic margin armed with (eight to nine) moderately well separated spines, which increase moderately in length distad (particularly in the females, length of longest, ♂ .3, ♀ .8 mm.). The costal margin of the tegmina is weakly serrulate, this strongest meso-distad. In the females the pronotum has the margins of the collar moderately denticulate, the denticulations of the cephalic half of the shaft weak, the shaft with medio-longitudinal carina well developed. In this sex the tegmina extend considerably beyond the apex of the abdomen, with marginal field proportionately narrower than in females of *venosa* and with stigma smaller (length 2.4 and 2.9 mm.).

The adult specimens before us are all dried alcoholic. One only shows the cephalic trochanter with apex slightly darkened, but all show subobsolete traces of darker suffusions on the inner faces of the cephalic femora, as described for *venosa*. From this feature we believe that *H. tenuis* Giglio-Tos is a member of the same phy-

lum, though particularly distinct in having the margins of the male pronotum crenulate. The margins of the male pronotum are entire, with no trace of denticulation, in both *vitrea* and *venosa*.

***Hierodula venosa* (Olivier).**

1792. *Mantis venosa* Olivier, Encycl. Méthod., VII, p. 639, No. 73. [[♀]; Tranquebar, [India].]

Labuan Island, British North Borneo, 2 ♀.

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂.

This material, compared with specimens which we consider representative of *H. vitrea* (Stoll), shows that very close affinity exists.

We separate the material here recorded by the more numerous (twelve to fourteen)⁴⁴ and closely placed spines of the cephalic margin of the cephalic coxæ, which increase somewhat irregularly but strongly in length distad (particularly in females, length of longest spine, ♂ .8, ♀ 1.3 mm.). The costal margin of the tegmina is distinctly, moderately strongly serrulate. In the females the pronotum has the margins of the collar and cephalic half of the shaft strongly denticulate, the shaft with medio-longitudinal carina subobsolete or weakly defined. In this sex the tegmina reach only slightly beyond the apex of the abdomen, with marginal field proportionately broader than in females of *vitrea* and with stigma more ample (length 3.7 and 4.9 mm.).

Measurements (in millimeters).

	♂	Length of body.	Length of pronotum.	Greatest width of pronotum.	Least width of pronotum.	Length of tegmen.
Sandakan, Borneo.....		71	23.5	6.8	4.4	52.2
	♀					
Labuan Island, Borneo....		68	25	7.8	4.9	41.6
Labuan Island, Borneo....		79	27	9	5.3	51.1

The width of the marginal field of the tegmina in the male is 4.4, in the females 5.6 and 5.8 mm.

In the specimens at hand the cephalic trochanters are brown at the apex, the femora above this point, above the first discoidal spine and above the first and fifth larger spines of the ventro-internal margin are flecked with brown. These markings are decided in one female, very faint in the other two specimens. The larger female has the stigma with small brown suffusions proximad and

⁴⁴ Interspaced with additional very small nodiform spines.

distad, the male shows a trace of such marking, while the remaining female has the stigma immaculate.

***Hierodula rajah* Werner.**

1911. *H[ierodula] rajah* Werner, Abhand. Senckenb. Naturforsch. Ges., XXXIII, p. 393. [♂, ♀; Nias [Island], Moluccas.]

Nias Island, Moluccas, 1 ♀.

The following features are noted in the female before us of this large and striking species, originally very briefly described. Facial scutellum with lateral margins straight, weakly but distinctly convergent dorsad; basal width (3.9 mm.) very slightly greater than median height (3.8 mm.); surface showing two vertical, parallel carinæ, broken meso-ventrad as in *H. venosa* (Olivier) but decidedly weaker than in that species. Cephalic coxæ with (eight and nine) small, stout, irregularly placed, conical teeth, which do not become longer distad. Cephalic femora with discoidal spines, first small spine beyond unguicular sulcus and all large spines of ventro-internal margin black, a fleck of black disto-internally on the trochanters, a large blotch of the same color from the apex of the trochanters to and including the unguicular sulcus, a small blotch at base of the first two black spines beyond, continued to the second large black spine of the series, and a spot of black at the base of each other large black spine of the series. All spines of cephalic femora and tibiæ black tipped. Joints of cephalic tarsi entirely black on their inner faces. Pronotum with marginal denticulation pronounced on lateral portions of collar only. Tegmina with discoidal field translucent, moderately hyaline; marginal field opaque, with margin almost entire, showing feeble traces of serrulation meso-distad; stigma large, cream colored.

The species would appear to agree more nearly with *H. timorensis* (Haan) than with any of the other related species.

Length of body 88, length of pronotum 33, greatest width of pronotum 10.1, least width of pronotum 5.8, length of tegmen 58.8, width of tegminal marginal field 6.2, length of stigma 4.3, length of cephalic femur 25, length of caudal femur 25.6 mm.

***Hierodula patellifera* (Serville).**

1839. *Mantis patellifera* Serville, Hist. Nat. Ins., Orth., p. 185. [♂, ♀; Java.]

1839. *Mantis bipapilla* Serville, Hist. Nat. Ins., Orth., p. 188. [♂, ♀; Java.]

1870. *H[ierodula] manillensis* Saussure, Mittheil. Schweizer Ent. Gesellschaft, III, p. 233. [♂, ♀; Manila, [Philippine Islands].]

1904. *H[ierodula] saussurei* Kirby, Syn. Cat. Orth., I, p. 245. [♂, ♀; China; Java.]

1912. *H[ierodula] manillana* Giglio-Tos, Bull. Soc. Ent. Italiana, XLIII, p. 96. [♂, ♀; Manila, Philippine Islands.]

Saussure first pointed out the synonymy of *patellifera*, *bipapilla* and *manillensis*.

From study of the literature, the material here recorded and a moderately large Japanese series in the Philadelphia Collections, we are convinced that we here have to deal with an exceedingly plastic species. The name *saussurei* was proposed for a condition in which the prosternum is immaculate, *manillana* for a condition in which the cephalic femora are suffused with black on their internal faces from base to unguicular sulcus.

The prosternum varies from immaculate to a heavily twice banded type, the degree of banding, when present, individually differing greatly as shown in the Japanese material at hand. The maculation of the cephalic femora appears to us to be a similarly individual color variation in this insect. In this species the costal margin of the tegmina is smooth, rarely showing faint traces of serrulation.

Giglio-Tos has attempted to separate *bipapilla* from *patellifera* on the basis of differences in pronotal curvature and other features, all of which we are satisfied are of no specific diagnostic value for this plastic insect.

Cuernos Mountains, Island of Negros, Philippine Islands, (from C. F. Baker), 1 ♂.

Manila, Island of Luzon, Philippine Islands, September, 1918, (R. C. McGregor), 1 ♀, [Academy of Natural Sciences of Philadelphia].

Los Banos, Laguna, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♀.

Mt. Makiling, Island of Luzon, Philippine Islands, (from C. F. Baker), 2 ♀.

The Manila specimen is green and has the internal face of the cephalic femora suffused with blackish brown ventro-proximad. The other specimens are light or dark brown, that from Los Banos being much the smallest. The darkest individual from Mt. Makiling is strongly mottled and has the internal face of the cephalic femora weakly suffused with dark brown ventro-proximad.

***Hierodula aruana* Westwood.**

1889. *Hierodula aruana* Westwood, Rev. Ins. Fam. Mantidarum, p. 35, pl. IV, fig. 4. [♀, Aru Islands.]

Setekwa River, opposite Aru Islands on south coast of Dutch New Guinea, (A. S. Meek), 1 ♀.

This female has a close general resemblance to the female of *H. rajah* Werner here recorded, but is somewhat smaller and shorter. The coloration of the prosternum, mesosternum, cephalic coxæ and femora readily distinguish these species, which we do not believe will be found nearly as plastic as the species more closely related to *vitrea* and the variable *patellifera*.

The costal margin of the tegmina is rather strongly serrate in this specimen. Length of body 75, length of pronotum 28.2, greatest width of pronotum 9.2, least width of pronotum 5.8, length of tegmen 51, width of tegminal marginal field 6.2, length of cephalic femur 23.3, length of caudal femur 23.8 mm.

***Hierodula laevicollis* Saussure.**

1870. *H[ierodula] laevicollis* Saussure, Mélang. Orth., I, p. 230. [♂, Amboina.]

1871. *H[ierodula] ovata* Saussure, Mélang. Orth., I, p. 409. [♀, Amboina.]

The association of the sexes in the present series is unquestionably correct, and shows that Saussure described the female of this species as *ovata*.

Island of Amboina, Moluccas, 7 ♂, 2 ♀, 1 juv. ♀, [Academy of Natural Sciences of Philadelphia].

In both sexes the facial scutellum has its basal width equalling its height, with lateral margins parallel in the males, very feebly convergent dorsad in the females and with the two vertical and parallel carinæ subobsolete as to elevation but well defined throughout in paler coloration, each showing an impressed puncta slightly below the median point. The lateral margins of the pronotal collar are smooth to very feebly tuberculate in the males, weakly tuberculate in the females. The pronotal shaft has a medio-longitudinal carina, subobsolete to moderately developed in the males, moderately developed in the females, and in the males only, the caudal margin is bordered to varying degrees with a blackish brown suffusion. The costal margins of the tegmina are smooth, showing mere traces of denticulation under high magnification. The large oval buffy stigma in the males contrasts strikingly with the transparent, hyaline but brown tinged discoidal fields of the tegmen. The cephalic coxæ are armed with (six to eight in the series) small, bluntly conical teeth in the males, with (six to seven in the series) rather heavy bluntly conical teeth in the females.

***Hierodula obiensis* new species. (Plate II, figures 1 and 2.)**

This interesting species is closely related to *H. laevicollis* Saussure, both sexes differing from that species in being of smaller size, with

facial scutellum decidedly transverse, not of almost equal height and width, and with markings and coloration different.

TYPE.—♂; Obi Island, Moluccas. [Hebard Collection Type No. 524.]

Size small, form rather slender for the genus. Ocelli large, closely placed, arranged in a triangle slightly broader than high. Facial scutellum transverse, height approximately three-fifths basal width; vertical parallel carinae subobsolete, the two lateral sections of the scutellum each with a small dark brown suffusion mesad; dorsal margin of scutellum moderately convex, showing an indication of mesal angulation. Pronotum as in *laevicollis*, except that all trace of medio-longitudinal carination on the shaft is lost; supra-coxal expansion moderate, more decided than in *H. venosa* (Olivier), as in *laevicollis*, very slightly weaker than in *H. sorongana* (Giglio-Tos), margins smooth, caudad briefly margined with a narrow dark suffusion as in this sex of *laevicollis*, this feature indicated to a much less degree in the male of *sorongana* before us. Tegmina and wings much as in *laevicollis*, extending well beyond apex of abdomen; marginal field opaque, broad proximad, narrowing rapidly mesad, very narrow in distal half; remaining portions clear hyaline, with cross-veinlets brown for a brief distance from each vein; stigma small, linear, hardly opaque. Limb armament exactly as in *laevicollis*. Cephalic coxae with cephalic margin armed with (six and eight) very small bluntly conical teeth. Cephalic femora with genicular areas each supplied with a small blunt spine; ventro-internal margin with the following formula, I I I I I I I I I I, these spines black tipped, the larger spines of this series as well as the first and third discoidal spines tawny, with a distinct basal suffusion of this color on the limb except for the discoidal spines. Cephalic tibiae with eleven ventro-external and fourteen ventro-internal spines, the external series beginning a slight distance from the tibial base. Caudal metatarsus approximately equal in length to that of the succeeding joints.

ALLOTYPE.—♀; same data as type. [Hebard Collection.]

Agrees closely with this sex of *laevicollis*, differing in the smaller size and facial scutellum, which is as described for the male of this species, thus differing only in having the dorsal margin more broadly convex. Compared with the male type of this species, this sex is seen to differ in the more robust form, ocelli which are much smaller and more widely spaced, pronotum with lateral margins microscopically denticulate before the supra-coxal expansion, minutely

but distinctly denticulate on the collar, with shaft showing a weak but distinct medio-longitudinal carina. The tegmina and wings reach only to base of supra-anal plate. The tegmina are opaque, with stigma more decided. The cephalic coxæ are armed with (six and seven) rather heavy, rounded teeth.⁵⁵ The supra-anal plate is very strongly transverse, its length hardly over one-fifth its basal width, with distal margin very broadly convex.

Male with head ochraceous-tawny, facial scutellum with two small suffusions of slate color meso-laterad, eyes dark hazel. Pronotum cinnamon-brown, caudal margin and proximal portion of lateral margins for a brief distance suffused with blackish brown. Tegmina with marginal fields opaque, biscay green, the numerous irregular veinlets vinaceous-brown; remaining portions transparent, clear hyaline, except the transverse veinlets, which are all briefly mummy brown from the points of intersection with the veins. Limbs pale green. Cephalic femora with the first and third discoidal spines tawny, the longer spines of the ventro-internal margin tawny, each with a small basal suffusion on the limb of tawny.

Female with occiput between eyes mummy brown, eyes rich tawny, face light ochraceous salmon, facial scutellum with a small slate colored suffusion meso-laterad on each side, which is slightly larger than in the male. Caudal portion of occiput, all of pronotum and limbs snuff brown, the pronotum somewhat irregularly tinged with blackish brown caudad. Spines of cephalic coxæ light buff, larger femoral spines tawny as in male. Tegmina opaque, pale yellowish green,⁵⁶ stigma cream color.

Length of body ♂ 52.8, ♀ 54.6; width of head ♂ 7, ♀ 8; length of pronotum ♂ 17, ♀ 19; greatest width of pronotum ♂ 4.9, ♀ 5.8; least width of pronotum ♂ 2.9, ♀ 3.1; length of tegmen ♂ 41.2, ♀ 28.6; width of tegminal marginal field ♂ 2.9, ♀ 3; stigma ♂ 3.2 by .7, ♀ 2.9 by .8; length of cephalic femur ♂ 12.7, ♀ 14.7; length of caudal femur ♂ 14.3, ♀ 14.9 mm.

This species is known from the single pair.

***Hierodula sorongana* (Giglio-Tos).**

1912. *P[arhierodula] sorongana* Giglio-Tos, Bull. Soc. Ent. Italiana, XLIII, p. 120. [♀; Mansinam and Sorong, New Guinea.]

Haidana, Collingwood Bay, British New Guinea, April to May, 1907, (from A. S. Meek), 1 ♂.

⁵⁵ In this respect the contrast between the sexes is exactly as in *laevicollis*.

⁵⁶ Apparently decidedly faded from the coloration in life.

After careful study of the literature, we place this insect under Giglio-Tos' *sorongana*, though that species is described from females and the description palpably insufficient.

No difference of note in the present example is remarked, except that the types are described as having the metazona distinctly tectiform carinate, while in the present specimen it is evenly rounded with carination subobsolete. Such difference between the sexes is shown by the series of *H. laevicollis* Saussure before us, so that we feel our present association to be justified.

When compared with males of *laevicollis*, the present male is seen to represent a species belonging to the same phylum. It differs in the facial scutellum being of the same proportions but with parallel vertical carinæ weak but distinct, broken slightly below the middle, with brief ventral portions slightly the more developed, much as in *H. venosa* (Olivier). The pronotum is slightly smaller in proportion to the rest of the body but of exactly the same character, with caudal margin of shaft showing only a very weak darker suffusion. The denticulations of the cephalic coxæ are more numerous (eight and nine), irregular and very slightly more slender. The tegmina have the discoidal field transparent, hyaline and colorless, while the stigma is much less conspicuous, narrower (3.1 by 4, in *laevicollis* 3.5 by 1.1 mm.) and the costal margins of the tegmina are minutely denticulate, this well developed meso-distad.

Length of body 61, length of pronotum 20.2, width of pronotum 5.9, length of tegmen 46.7, width of tegminal marginal field 3.5, length of cephalic femur 17.3, length of caudal femur 15.4 mm.

THE TAMOLANA GROUP OF THE GENUS HIERODULA.

Of the species assigned by Giglio-Tos to his subgenus *Rhomboderula*, of his genus *Parhierodula*, but two, *saussureii* Kirby and *extensicollis* Serville, are referable to *Rhombodera*.

The others constitute a group, reaching its maximum development in Papua, which includes types, annectant to varying degrees, between the typical forms of *Hierodula* and *Rhombodera*. Of these, *atricoxis* Wood-Mason shows the most decided approach toward the type of pronotal development characteristic of *Rhombodera*.

These species may represent a valid generic unit or a subgenus of *Hierodula*, but for the present we believe it best to assign them as a group of that genus, which we term the Tamolana Group. All are distinguished by the pronotal expansion being slightly to de-

cidedly wider than the width of the head and all are conspicuous in form and coloration. We would place these species in the following order: *pectoralis* (Wood-Mason), *denticulata* (Krauss), *phryne* Stål, *splendida* here described, *tamolana* (Brancsik), *atricoxis* Wood-Mason. Three species described by Giglio-Tos, *andaina*, *dilena* and *katauana*, undoubtedly belong to this group, but the descriptions are given over almost entirely to discussion of coloration and without figures we are unable to determine accurately their affinities.

***Hierodula denticulata* (Krauss).**

1902. *R[hombodera] pectoralis* variety *denticulata* Krauss, Orth. Austr. Malay. Archip., p. 756, pl. LXVII, fig. 4. [♀, British New Guinea.]

Setekwa River, Dutch New Guinea, (from A. S. Meek), 1 ♀.

The present specimen differs from the type in having internal surface of the cephalic coxæ entirely black, instead of black in the distal third. The distribution of the dark coloration on this surface has been used as an important specific diagnostic character by Giglio-Tos, but we are by no means convinced that it is not subject to decided individual variation, at least within certain species, its extent governed by intensification and recession of the color pattern. So closely does the present specimen agree in other respects with Krauss' description and excellent figure that we would consider description of the present example as a new species both rash and unwarranted at the present time.

The present specimen has the shaft of the pronotum slightly darkened on each side proximad and mesad and heavily suffused briefly latero-caudad and along the caudal margin with blackish brown. The cephalic femora have a broad transverse bar mesad on their external faces of dark brown. The apex of the cephalic trochanters and adjacent portion of the inner face of the cephalic femora are blackish brown, while the discoidal spines and the first two and all the longer spines of the series on the ventrointernal margin of the cephalic femora have their internal faces blackish brown, this color spreading briefly at their bases on the inner surface of the limb. The prosternum has two large round blackish spots near its caudal margin, the mesosternum two similar but slightly larger spots, while between the median coxæ are two other dark suffusions.

It would appear that Giglio-Tos' *andaina*, *dilena* and *katauana* may prove to be other color variants or geographic races of *H. pectoralis* (Wood-Mason) or the present species. With descriptions.

given over almost entirely to color description and with no figures, particularly necessary to show the pronotal contour, the descriptions of these species as given have only added to the difficulties encountered, and instead of representing an addition to scientific knowledge, are in fact a distinct retrograde step.

Length of body 93, width of head 12, length of pronotum 28.8, greatest width of pronotum 12.7, length of pronotal shaft 20.7, width of unexpanded portion of shaft 6.5, length of tegmen 53, width of tegminal marginal field 6.6, length of cephalic femur 23, length of caudal femur 22.3 mm.

Hierodula splendida new species. (Plate II, figure 3.)

The present species is distinguished from all others of this section which have been properly characterized, excepting *H. tamolana* (Brancsik) by the expansion of the pronotum, which is decidedly greater than the cephalic width, but narrows sharply caudad, leaving slightly less than half of the shaft without expansion. Compared the figure and description of males of *tamolana*, the male under consideration is found to differ in the more evenly rounded margins of the supra-coxal expansion, which are smooth, without trace of denticulation. The cephalic coxæ are black on their internal faces only in the distal fourth, but this coloring appears to be individually variable in extent in species of the present group.

TYPE.—♂; Haidana, Collingwood Bay, British New Guinea. April to June, 1907. (From A. S. Meek.) [Hebard Collection Type No. 525.]

Size large, form rather robust, as in many species of the *Tamolana* Group. Ocelli large, rather closely placed in a triangle slightly wider than high. Facial scutellum with height equal to basal width, dorsal margin rather strongly convex, surface with two vertical parallel carinæ very weakly indicated. Pronotum with lateral margins smooth, shaft without trace of carina, supra-coxal expansion pyriform, considerably wider than head, margins very weakly concave-convergent cephalad, evenly convex caudad to juncture with unexpanded portion of shaft, which portion constitutes nearly half the length of the shaft. Tegmina with marginal field opaque, broad, narrowing evenly and gradually distad from point of greatest width; remaining portions transparent, hyaline, weakly tinged with brown except proximad toward marginal fields where they are embrowned and subopaque, stigma rather heavy and conspicuously pale. Cephalic coxæ with cephalic margin moderately lamellate,

armed with (eight and ten) small and very bluntly rounded spines which become slightly longer than wide distad, these irregularly interspaced with a few minute spinulæ, other margins roughly and bluntly nodulose. Cephalic femora with the characteristic armament of I I I I I I I I I I spines, genicular lobes each supplied with a very minute, blunt, short, stout spine. Cephalic tibiæ with ventral margins armed with eleven external and fourteen internal spines.

Head, pronotum, body and limbs tawny olive. Cephalic femora with a broad but weakly defined transverse suffusion of warm sepia. Tegmina with marginal fields and adjacent portions proximad mars brown; remaining portions transparent, very faintly tinged with mars brown; stigma cream color, with a brief but heavy suffusion proximad and distad of blackish chestnut brown. Cephalic coxæ with distal fourth of internal surface shining black,⁵⁷ apex of cephalic trochanters and adjacent area of cephalic femora blackish brown. First and third discoidal spines and all large spines of ventro-internal margin of cephalic femora blackish brown, this color very briefly suffusion the femoral surface at the bases of all the large marginal spines. Prosternum with four small flecks of blackish brown in its caudal portion, mesosternum with two larger flecks of the same coloration.

Length of body 70, width of head 9.6, length of pronotum 22.8, greatest width of pronotum 12.4, length of pronotal shaft 16.7, length of unexpanded portion of shaft 7.3, width of unexpanded portion of shaft 5.7, length of tegmen 56, width of tegminal marginal field 5, length of cephalic femur 17.9, length of caudal femur 18.8 mm.

The type of this handsome insect is unique.

RHOMBODERA Burmeister.

1838. *Rhombodera* Burmeister, Handb. Ent., II, Abth. II, pt. 1, p. 536.

1912. *Rhomboderula* Giglio-Tos, subgenus of *Parhierodula* Giglio-Tos, Bull. Soc. Ent. Italiana, XLIII, p. 130.

Having selected *Rhombodera saussurei* Kirby as genotype of *Rhomboderula* in the present paper, we find this species to be congeneric with *Mantis valida* Burmeister, genotype of *Rhombodera*.⁵⁸ The resultant synonymy is indicated above.

⁵⁷ The following features of coloration have been extensively used by Giglio-Tos in characterizing the species of *Hierodula* and its allies. In the present group we feel that individual variation occurs in at least some of the species and must be taken into consideration.

⁵⁸ Selected by Kirby, Syn. Cat. Orth., I, p. 248, (1904).

We refer to our discussion of the values of the generic characters, used to separate the genera of the Group Hierodulæ, under the group heading on page 51. We there explain our reasons for repudiating Giglio-Tos' rearrangement and the new genera and subgenera which he was obliged to erect after he had decided to consider the smoothness or serrulation of the costal margins of the tegmina of primary importance.

On page 63, under the Tamolana Group of the genus *Hierodula*, we discuss the majority of the species which Giglio-Tos referred to his subgenus *Rhomboderula*.

***Rhombodera extensicollis* (Serville).**

1839. *Mantis extensicollis* Serville, Hist. Nat. Ins., Orth., p. 189. [♂, ♀; Java.]

Samarang, Java, July, 1909, (E. Jacobson), 1 ♂, [Academy of Natural Sciences of Philadelphia].

This specimen agrees fully with Giglio-Tos' diagnosis of *extensicollis*, which species he placed in his subgenus *Rhomboderula* of his genus *Parhierodula*.

Rehn has recorded the present specimen as *Rhombodera flava* (Haan),⁵⁹ which species is closely related and may prove a synonym of *extensicollis*, as was indicated by Kirby, but resurrected as valid by Giglio-Tos and placed by that author in *Rhombodera*, which he considered a subgenus of *Hierodula*.

***Rhombodera stalii* Giglio-Tos.**

1877. *H[ierodula] basalis* Stål, (not *Mantis basalis* Haan, 1842), Bih. till K. Svenska Vet. Akad. Handl., IV, No. 10, p. 21. [Java, Borneo.]

1912. *H[ierodula] R[hombodera] stalii* Giglio-Tos, Bull. Soc. Ent. Italiana, XLIII, p. 102. [♂, ♀: southern Java; Tengger Mountains, Eastern Java.]

Nongkodjajar, Java, January, 1911, (E. Jacobson), 1 ♂, 1 ♀, [Academy of Natural Sciences of Philadelphia].

These specimens have been recorded by Rehn as *R. basalis* (Haan).⁶⁰ Giglio-Tos has proposed the name *stalii* for a form with narrowed pronotum and apex of cephalic trochanters darkened. The present specimens agree with that author's diagnosis except that they are smaller.

We hesitate to use the name *stalii* for we are by no means convinced that this type will not prove to be a geographic race or even a mere variant of *basalis*, unworthy of nominal recognition.

⁵⁹ Notes from Leyden Mus., XXXV, p. 125, (1912).

⁶⁰ Notes from Leyden Mus., XXXV, p. 125, (1912).

Length of body ♂ 56, ♀ 64.5; length of pronotum ♂ 20.3, ♀ 23.7; greatest width of pronotum ♂ 11, ♀ 14.7; length of tegmen ♂ 50.2, ♀ 45.5; width of tegminal marginal field ♂ 4.7, ♀ 5.8 mm.

Rhombodera basalis (Haan).

1842. *M[antis]* (*Mantis*) *basalis* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 67. [♀; Krawang, Java.]

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♀.

This is a large specimen; length of body 85, length of pronotum 30, width of pronotum 18.7 mm.

Rhombodera valida Burmeister.

1838. *M[antis]* (*Rhombodera*) *valida* Burmeister, Handb. Ent., II, Abth. II, pt. I, p. 536. [Java.]

Labuan Island, British North Borneo, 1 ♂.

This species is separated by Giglio-Tos from *R. basalis* (Haan) by the broader, sub-circular, rhomboidal pronotum and quadri-ramose discoidal vein of the tegmina. The material measured by that author does not show as broad a pronotum as does the present specimen, but from study of his paper we are led to believe that the measurement given for pronotal width may not be correct.

The additional ramus of the discoidal vein of the tegmina is clearly a poor specific criterion, noting that the same vein is bi- or tri-ramose in *basalis*, as stated by Giglio-Tos.

As a result we feel that the specific validity of the condition to which the name *valida* is applied is open to question, the position which we take being much the same as stated for *R. stalii* Giglio-Tos in the present paper. We are further strengthened in this opinion by the fact that Giglio-Tos has later described a species, *rotunda*,⁶¹ giving in his meagre comparative description, as differential characters to separate that form from *valida*, the broader pronotum and the fact that the four specimens before him have the cephalic femora with black maculations before the unguicular sulcus. The present specimen agrees closely with Giglio-Tos' measurements for *rotunda*, but has the cephalic femora immaculate.

Length of body 71, length of pronotum 21.6, greatest width of pronotum 16.3, length of tegmen 56, width of tegminal marginal field 4.4 mm.

⁶¹ Bull. Soc. Ent. Italiana, XLVIII, p. 65, (1917).

Rhombodera saussurei Kirby.

1842. *Mantis* (*Mantis*) *valida* Haan, (not *Mantis* (*Rhombodera*) *valida* Burmeister, 1838) in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 66. [Timor-Koepang; Amboina.]

1904. *R[hombodera]* *saussurei* Kirby, Syn. Cat. Orth., I, p. 248. (New name proposed.)

Obi Island, Moluccas, 1 ♂, 2 ♀.

This handsome species, though agreeing closely with *R. basalis* (Haan) in pronotal form, is clearly a member of a distinct species group, distinguished by the greater definition of the lateral wings of the pronotum from the primitive portion, the distinct and greater serrulation of the pronotal margins, the serrulate costal margin of the tegmina and clear hyaline wings, not tinged with pink as in *basalis* and its closer allies.

The present specimens, in addition, have the stigma buffy without adjacent suffusions of any kind, but this feature would appear to be variable, as Giglio-Tos records specimens from Timor with stigma showing blackish brown suffusions cephalad and caudad, as is characteristic for *basalis*.

From the data given in the literature, the size variation would appear to be considerable. The measurements of the specimens here recorded are: length of body, ♂ 71.5, ♀ 70–75.5; length of pronotum, ♂ 24.1, ♀ 25.2–26.2; greatest width of pronotum, ♂ 15.6, ♀ 17.2–18.3; length of tegmen, ♂ 64.1, ♀ 49.7–50.2; width of tegminal marginal field, ♂ 4.9, ♀ 5.9–6.3 mm.

XXIII. ARCHIMANTINÆ.

1ST GROUP, ARCHIMANTES.

Archimantis latistyla (Serville).

1839. *Mantis latistylus* Serville, Hist. Nat. Ins., Orth., p. 179. [♂, ♀; Australia.]

Queensland, Australia, 2 ♀.

Archimantis armata Wood-Mason.

1877. *Archimantis armatus* Wood-Mason, Ann. Mag. Nat. Hist., (4), XX, p. 76. [♀, North Australia.]

Townsville, Queensland, Australia, 1 ♀.

XXVIII. ACROMANTINÆ.

2D GROUP, ACROMANTES.

Oligomantis orientalis Giglio-Tos.

1915. *Oligomantis orientalis* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XXX, No. 702, p. 4. [♂, ♀; Redjang, Sumatra; Island of Batu; Singapore, [British Straits Settlements].]

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♂, 1 ♀.

The original description of this interesting species is inexcusably brief. No mention is made of the striking granulations covering the dorsal surface of the pronotum, which, in the female become minute but distinct tuberculations on the collar. The wings are transparent, tinged with a delicate pink, except proximad in the marginal field, where they are tinged with green.

The length of the female tegmen as given by Giglio-Tos, 13.5 mm., is apparently in error, as he states "elytris angustata, abdomine longiora." Probably 23.5 mm. was intended.

The measurements of the pair before us are as follows: length of body, ♂ 22, ♀ 34; length of pronotum, ♂ 8, ♀ 11.8; greatest width of pronotum, ♂ 1.9, ♀ 2.9; length of tegmen, ♂ 14.3, ♀ 23.7; width of tegminal marginal field, ♂ 1.2, ♀ 2; length of caudal femur, ♂ 5.3, ♀ 7.2 mm.

***Acromantis moultoni* Giglio-Tos.**

1915. *A[acromantis] moultoni* Giglio-Tos, Boll. Mus. Zool. Anat. comp. Univ. Torino, XXX, No. 702, p. 5. [♀; Borneo; Darvel Bay, Borneo.]

Sandakan, British North Borneo, (from C. F. Baker), 1 ♂, 1 ♀.

Giglio-Tos' treatment of eight new species, of which *moultoni* is the second, is pitifully superficial and brief, as usual without a single figure. Particularly reprehensible is the fact that in no case is a single transverse dimension given, leaving the reader in complete ignorance as to the slenderness or robustness of the species described.

The male before us has the margin of the suture mesad above the ocelli minutely angulate produced ventrad, as may be expected for this sex of a species of *Acromantis* in which the females have no trace of a tubercle at this point. This specimen very closely resembles the male before us of *A. oligoneura* (Haan), differing in not having a minute but distinct tubercle above the ocelli and in having the oblique portions of the discoidal and median veins of the tegmina more strongly curved toward their bases. The discoidal field of the tegmina is colorless, hyaline, weakly reticulated with green veins, the third and fourth of the oblique veins margined along their proximal portion with a brown suffusion.

The female has no trace of angulate production or tubercle above the ocelli. The discoidal field of the tegmina is colorless, hyaline, with veins similar to those of the male but with the reticulation somewhat smaller and closer and with no suffusions whatever. The

wings are truncate distad, with immediate apices showing very slight production.

It is clear that *moultoni* is very close to *oligoneura* and may prove to be a geographic race. Giglio-Tos' *insularis*, from the superficial description, is apparently even closer to *oligoneura* and may represent a geographic race, but more probably an absolute synonym of that species.

Length of body, ♂ 21.8, ♀ 28; length of pronotum, ♂ 7, ♀ 8.3; greatest pronotal width, ♂ 2.4, ♀ 2.9; length of tegmen, 17.6, ♀ 21.2; width of tegminal marginal field, ♂ 1.4, ♀ 2; width of cephalic femur, ♂ 1.7, ♀ 2.2 mm.

***Acromantis oligoneura* (Haan).**

1842. *M[antis] oligoneura* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 90, pl. XVIII, fig. 6. [♂, ♀: Java; Padang; Amboina; Tonda, [Celebes].]

Batavia, Java, June and September, 1908, (E. Jacobson), 1 ♂, 1 ♀, [Academy of Natural Sciences of Philadelphia.]

These specimens have been correctly recorded by Rehn.⁴² The measurements are: length of body, ♂ 21, ♀ 26; length of pronotum, ♂ 6.3, ♀ 7.4; greatest width of pronotum, ♂ 2.1, ♀ 2.7; length of tegmen, ♂ 16.2, ♀ 18.8; width of tegminal marginal field, ♂ 1.2, ♀ 2; width of cephalic femur, ♂ 1.7, ♀ 2.1 mm.

***Acromantis lusonica* new species. (Plate II, figure 4.)**

This species agrees with *A. parvula* Westwood⁴³ in size and in having the apex of the anterior field of the wings arcuate and not showing the truncation indicated to varying degrees in males of the other species known to us. It differs in having no supra-ocular spine, the pronotal supra-coxal expansion more decided, the tegmina and wings not surpassing the apex of the abdomen, the tegmina with all fields equally tinged with green and subopaque and the distal lobes of the median and caudal femora smaller, scarcely half as wide as the tibiae.

⁴² Notes from Leyden Mus., XXXV, p. 126, (1912).

⁴³ One of the most unsatisfactory features of Giglio-Tos' work lies in the fact that in his revisionary studies of the Acromantinae he has almost invariably failed to give any additional data for previously described species. Under *A. oligoneura* (Haan) he places *A. parvula* Westwood as a synonym, records material from Java and Borneo, but gives no data whatever concerning the specimens recorded or reasons for the synonymy indicated. The fact that the apex of the anterior field of the wings as figured by Westwood shows no truncation whatever causes us to believe *parvula* to be a valid species, which we here recognize. Westwood's description is unsatisfactory, but with his figure far more useful than the descriptions of new species of the genus *Acromantis* given by Giglio-Tos.

Compared with a male of *A. oligoneura* (Haan) before us, the present male is seen to differ widely in its smaller size, decidedly shorter and heavier pronotum with supra-coxal expansion more decided, much shorter tegmina and wings with distal margins showing no truncation, suffused tegmina with cross-veinlets very much more numerous and irregular and differently colored wings with apex of anterior field not distinctly truncate.

The position of the present species in the genus *Acromantis* is somewhat difficult to assign, due to the fact that the male sex of *A. australis* Saussure and the female sex of *luzonica* are unknown. The heavy pronotum and colored wings lead us to believe it to be more closely related to the group including *australis* than to that including the more slender species such as *oligoneura*. It is very possible that it represents a distinct group, in certain features annectant between these, but further material is needed before this can be definitely stated. From comparison with the male of *A. hesione* Stål before us, it is clear that the present species is widely separated from that insect, which is clearly the nearest approach among the species of the *australis* type toward those of the *oligoneura* type.

TYPE.—♂; Baguio, Benguet, Island of Luzon, Philippine Islands. (From C. F. Baker.) [Hebard Collection Type No. 528.]

Size small and form robust for the genus. Head with supra-ocular spine subobsolete, represented by a mere rounded node mesad on the transverse carina there formed. Occiput with lateral vertical sulcations alone distinct, the two mesad indicated only as shallow, broad, brief depressions below the summit, summit of occiput not raised above the eyes, nearly transverse, very weakly and broadly concave mesad and very weakly and broadly convex from lateral sulci to eyes. Ocelli not large, distinctly smaller than in this sex of *oligoneura* and not as closely placed, arranged in a triangle slightly wider than high. Pronotum strikingly heavy for the size of the insect, the few blunt teeth on lateral margins of shaft and neck heavy, distinctly heavier than those of *oligoneura*; supra-coxal expansion decided, margins smooth, forming a rounded angulation meso-cephalad, as in *oligoneura*. Tegmina short, not extending beyond apex of abdomen, entirely subopaque, in all fields thickly supplied with a network of minute irregular veinlets; marginal field broad, narrowing gradually to near apex of tegmina; the four oblique veins of the discoidal field straight, not curved at their bases; the apices of the tegmina moderately broadly rounded, but with

curvature at apex more decided than in *oligoneura*. Wings extending as far as tegmina, with apices similar except that the curvature at the apex is slightly broader, these organs distinctively colored. Cerci short, stout, apex acute, joints moderately moniliform. Cephalic coxæ with cephalic margin armed with (six) small, blunt, irregularly placed teeth. Cephalic femora lamellate dorsad, the dorsal margin evenly and weakly convex; ventro-internal margin with spines arranged, as characteristic for the genus, in the following formula, I I I I I I I I I I, all genicular lobes each armed with a short heavy spine. Cephalic tibiæ with eleven external and eleven and twelve internal spines on the ventral margins. Median and caudal femora dorso-distad each produced caudad in a longitudinal lamella, only two-thirds as wide as tibia, the margin of which is broadly convex.

Head and pronotum cinnamon brown, the latter paling slightly toward ochraceous-tawny dorsad. Tegmina subopaque, immaculate, strongly tinged with ecru-olive (probably much faded from the color in life). Wings tinged with ochraceous-orange, this becoming ochraceous-tawny along costal margin distad in anterior field. Cephalic limbs olive lake, the coxæ and tibiæ suffused with brown, the femora showing traces of two pale transverse bands and with the larger spines of the ventro-internal margins colored as the other spines, the tips alone darkened. Caudal limbs olive lake, the femora heavily suffused with blackish chestnut brown in proximal and distal third and with traces of this color mesad, the tibiæ annulate proximad, mesad and distad with this color, the tarsal joints suffused distad. (The ground color of the limbs is apparently much faded from the color in life.)

Length of body 19.2, length of pronotum 5.9, greatest width of pronotum 2.6, width of pronotal shaft 1.6, length of tegmen 12.3, width of tegmen 4.4, width of tegminal marginal field 1.1, length of cephalic femur 5.8, width of cephalic femur 1.9, height of lamella on caudal femur .4, length of caudal femur 4.9 mm.

The type of this extraordinary little mantid is unique.

***Acromantis hesione* Stål.**

1877. *A[cromantis] hesione* Stål, Ofv. Kongl. Vetensk.-Akad. Förh., 1877, No. 10, p. 38. [♀, Philippine Islands.]

Los Banos, Laguna, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♂.

Davao, Davao, Island of Mindanao, Philippine Islands, (from C. F. Baker), 1 ♀.

The present species clearly belongs to the group which includes *A. australis* Saussure. This is shown by the robust form and cephalic femora having a dorsal expansion, weak but distinct in the males, conspicuous in the females.

The male before us is apparently an example of recessive coloration. The general coloration is yellowish, the cephalic femora weakly suffused with pale brown meso-distad on their external faces, the other femora suffused proximad and distad with pale brown. The tegmina have the discoidal fields transparent, hyaline, immaculate, with veins yellowish.

The female at hand is similar except that the general coloration is light brown, the cephalic femora dorsad suffused with slightly darker brown proximad, mesad and distad on their external faces. The tegmina have the discoidal fields transparent but heavily and evenly reticulate with innumerable pale brown veins, so that these areas appear only slightly vitreous, with third and fifth oblique veins showing a small but distinct maculation of dark brown about their bases.

Length of body, ♂ 25, ♀ 33; length of pronotum, ♂ 8, ♀ 9; greatest pronotal width, ♂ 2.5, ♀ 3.6; length of tegmen, ♂ 18.8, ♀ 21.9; width of tegminal marginal field, ♂ 1.3, ♀ 2.4; width of cephalic femur, ♂ 2, ♀ 3 mm.

***Acromantis australis* Saussure.**

1871. *Acromantis australis* Saussure, Mélang. Orth., I, p. 449, pl. VII, fig. 68. [♀: Moluccas; Island of Waigiou.]

Fakfak, Dutch New Guinea, 1 ♀.

This is the only species of the genus before us which has a well developed conical projection above the ocelli; this projection slightly higher but more slender than that at the dorsal apex of the facial scutellum in the female sex. The present specimen has the free margin of the axillary field of the wings tinged with dark brown, as described for Bornean material of *A. aruana* Westwood, a name which has been assigned to synonymy under *australis*.

Length of body 32, length of pronotum 9.3, greatest pronotal width 3.8, length of tegmen 22.8, width of tegmen 7, width of tegmen at apex 4.8, width of tegminal marginal field 2.3, width of cephalic femur 2.9, height of lamella on caudal femur .9 mm.

***Acromantis dyaka* new species. (Plate II, figure 5.)**

This species is the heaviest of the genus, showing the maximum development of pronotal marginal denticulation and femoral lamel-

lation. In addition the tegmina and wings show the most decided distal truncation known.

Nearest relationship is with *A. australis* Saussure, the present female differing from a female of that species before us, in addition to the features stated above, in having the spine above the ocelli minute, very much smaller than the spine above the summit of the facial scutellum, the tegmina with marginal field fully as broad proximad but narrowing sharply in distal third, rather than narrowing very gradually. The free margin of the axillary field of the wings is not tinged with dark brown, agreeing in this respect with all known material of *australis* from Waigiou and the Aru Islands, which marginal suffusion distinguishes, however, all material of that species known from New Guinea.

Type.—Labuan Island, British North Borneo. [Hebard Collection Type No. 527.]

Size large and form very robust for the genus, generally similar to *australis* except in the following respects. Head with supra-ocellar spine represented by a minute blunt projection less than half as high as the spine at the dorsal apex of the facial scutellum, which spine is as well developed as in *australis*. Occiput with four deep and broad vertical sulcations; summit of occiput slightly raised above the eyes, transverse, weakly convex from lateral sulci to eyes. Ocelli small, slightly smaller than in this sex of *australis*, similarly arranged in a triangle which is distinctly wider than high. Pronotum similar to that of *australis* except that it is shorter and heavier with the blunt teeth on the lateral margins fewer in number but decidedly heavier and longer. Tegmina as in that species but suddenly and broadly truncate distad, almost as if the distal quarter of a tegmen, such as is developed in *australis*, had been clipped off; marginal field very broad in proximal two-thirds, suddenly narrowing so that it is obsolete in the greater portion of the distal third; marginal field opaque, dorsal field transparent but with a heavy network of minute veins, which become so numerous and crowded toward the marginal field, and particularly toward the bases of the oblique veins, as to cause these portions to be almost opaque. Wings with anterior field sharply truncate, hardly reaching beyond apex of axillary field, portion of anterior field between mediastine vein and free margin opaque along the distal portion of the anterior field; axillary field transparent, very weakly tinged with brown. Cephalic coxæ with cephalic margin armed with (six) heavy blunt

teeth, between which are a number of minute denticulations. Cephalic femora lamellate dorsad, this somewhat strongest mesad, the dorsal margin minutely denticulate; ventro-internal margin with spines arranged as follows, $\text{I I I I I I I I I I}$, as characteristic of the genus, all genicular lobes each armed with a short heavy spine. Cephalic tibiae with eleven and twelve procumbent external and twelve internal spines on the ventral margins. Median and caudal femora dorso-distad each produced caudad in a large rounded lamella, similar to those developed in *australis*, but distinctly more ample.

Head tawny olive. Pronotum sepia laterad, fading to cinnamon-buff mesad particularly on shaft, with teeth of lateral margins black. Tegmina with marginal field opaque, turtle green; other portions hyaline with a network of tawny olive veins as given in description, with a suffusion of warm sepia about base of third oblique vein. Wings hyaline very faintly tinged with ochraceous-tawny, except along free margin of anterior field distad where they are opaque, antimony yellow shading through tawny to prout's brown at apex, the tawny and prout's brown portions spreading over the distal extremity of the anterior field. Limbs prout's brown; teeth of cephalic coxae buffy; internal faces of cephalic femora tawny; second and third discoidal spines black proximad and distad, larger spines of ventro-internal margin entirely black, this extending on the limb as a suffusion at the base of each of these spines; dorsal margin of cephalic femora, internal face of cephalic tibiae and median and caudal femora and tibiae each with two very pale brown areas, tarsal joints pale with apices darkened.

Length of body 28.5, length of pronotum 8.7, greatest pronotal width 4, length of tegmen 19, greatest tegminal width 7, width of tegmen at apex 6.7, width of tegminal marginal field 2.2, length of cephalic femur 8.8, width of cephalic femur 2.8, length of caudal femur 7.7, height of lamella on caudal femur 1.2 mm.

The type is unique.

***Odontomantis javana javana* Saussure.**

1870. *M[icromantis] Odontomantis javana* Saussure, Mélang. Orth., I, p. 181. [♀, Java.]

Sandakan, British North Borneo, (from C. F. Baker), 2 ♂, 3 ♀.
Labuan Island, British North Borneo, 1 ♂, 2 ♀.

Puerto Princessa, Island of Palawan, Philippine Islands, (from C. F. Baker), 1 ♀.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Greatest width of pronotum.	Length of tegmen.
Sandakan, Borneo.....	16.7	4.6	2.1	11.3
Sandakan, Borneo.....	15	4.2	2	10
Labuan Island, Borneo.....	14.7	4.2	2	11.2
♀				
Puerto Princesa, Palawan.....	23	6.1	3	16.6
Sandakan, Borneo.....	23.7	6	2.9	17
Labuan Island, Borneo.....	24.4	5.8	2.8	17.3

***Odontomantis javana euphrosyne* Stål.**

1877. *O[dontomantis] euphrosyne* Stål, Ofv. Kongl. Vetensk.-Akad. Förh.,
1877, No. 10, p. 38. [♂, ♀; Philippine Islands.]

Davao, Davao, Island of Mindanao, Philippine Islands, (from
C. F. Baker), 2 ♂.

These specimens agree fully with Stål's meagre description of *euphrosyne*, which is briefly characterized as being larger with distal portion of anterior field of wings less produced and blunter than in *javana*. We note also that these specimens, when compared with Bornean males of *javana*, have the collar of the pronotum slightly more elongate, distinctly longer than the width at the supra-coxal sulcus; the anterior field of the wings distinctly more suffused than the other portions, not equally suffused, and the dorsal surface of the cerci, supra-anal plate and preceding segment suffused with blackish brown, not of the general coloration of the dorsal surface of the abdomen.

No other differences of any diagnostic value are found and we believe that *euphrosyne* represents a geographic race of *javana*.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Greatest width of pronotum.	Length of tegmen.	Length of caudal femur.
Davao, Mindanao.....	18.5	5.2	2.3	12.2	5.7
Davao, Mindanao.....	20	5.7	2.5	12.8	5.9

XXIX. HYMENOPODINÆ.**5TH GROUP, HYMENOPODÆ.*****Hymenopus coronatus* (Olivier).**

1792. *Mantis coronatus* Olivier, Encycl. Méthod., VII, p. 638. [♀ and
juv., Amboina.]

Nias Island, Sunda Archipelago, 1 ♀.

This specimen exactly resembles the excellent figure of this most remarkable pale yellowish mantid given by Stoll.

***Croebroter granulicollis* Saussure.** (Plate II, figure 6.)

1870. *Cr[oeobotra] granulicollis* Saussure, Mittheil. Schweizer Ent. Ges., III, p. 242. [♀, Siam?]

Singapore, British Straits Settlements, Malay Peninsula, (from C. F. Baker), 1 ♂.

Kirby has given Penang, British Straits Settlements, as the type locality for this species. We are unable to locate the source of his information.

The species was described from a female, but from the minute tubercle above the ocelli and moderately granulate pronotal surface we feel that the present association is correct.

This specimen is compared with a male of *C. meleagris* Stål as to the eyes, under the discussion of that species. We would further remark that the pronotum is regularly oval rather than quadri-lobate in form. The tegmina are transparent, hyaline, very weakly tinged with green, except proximad in the discoidal field, where this becomes stronger; with a very brief (1.8 mm. in length) transverse band of mustard yellow, bordered proximad by a black line at the end of the proximal third of the discoidal field.

Length of body 23, width of head 4.4, length of eye 2.8, length of pronotum 5, greatest width of pronotum 3, length of tegmen 21, width of tegmen 5.2, width of tegminal marginal field 1.3, length of abdomen 9.2, width of abdomen 5.1, length of cephalic femur 6.5, length of caudal femur 6.1 mm.

***Croebroter labuanæ* new species.** (Plate II, figure 7.)

The present species appears to find nearest affinity with *C. meleagris* Stål. Compared with a male of *meleagris*⁴ before us, the present male is found to differ in its somewhat smaller size, eyes which do not project as strongly, smaller pronotum, which is weakly granulate, with neck proportionately shorter and the margins of the neck, shaft and supra-coxal expansion all four showing about the same convexity. In addition the tegminal markings are much smaller, yellow, not orange, with the discal spot showing only a brief transverse black band which sends a short ray into the yellow area. These features of coloration may be variable within the species of the genus, however, and in the present case the differ-

⁴ As noted under *meleagris*, lack of material of *C. urbana* (Fabricius) prevents comparison, which species, from the literature, appears to be more nearly related to *C. granulicollis* (Saussure) in pronotal form, with lateral margins more evenly expanding and in consequence decidedly less cruciform, though agreeing with *labuanæ* and *meleagris* in having a well developed spine above the ocelli.

ences noted may be due wholly to individual recession of coloration from a type exactly similar to that shown by the male of *meleagris* at hand.

As in many genera including strikingly colored species, it is clear that features of coloration, some of which are unquestionably of doubtful specific diagnostic value, have been unduly emphasized in past literature, while a number of important structural characters have been overlooked or given but scant attention.

TYPE.—♂; Labuan Island, British North Borneo. [Hebard Collection Type No. 526.]

Size medium for the genus, tegmina and wings very elongate, proportionately much as in *meleagris* and considerably longer than in *granulicollis*, though the pronotum is decidedly smaller than in *meleagris* and of much the same size as in *granulicollis*.⁶⁵ Head with eyes greatly projecting, as characteristic for the genus, but distinctly less than in this sex of *meleagris* or *granulicollis*. Spine above ocelli well developed, as in *meleagris*. Pronotum⁶⁶ with dorsal surface feebly granulate; lateral margins very slightly roughened, denticulations obsolete except faintly indicated on cephalic margins of supra-coxal expansion, much as in *granulicollis*, slightly weaker than in *meleagris*; margins of neck, shaft and supra-coxal expansion all equally convex, giving the pronotum a more cruciform shape than in *meleagris*, which shape is practically lost in *granulicollis*; neck short, no longer than its proximal width. Tegmina and wings elongate, proportionately slightly narrower than in *meleagris*, of same proportions as in *granulicollis*, but more extensive in proportion to body bulk than in that species. Wings with a proximal suffusion of deep vinaceous, as in *granulicollis* and *meleagris*, markings of a much reduced but similar pattern to those of *meleagris*. Ninth dorsal abdominal segment with latero-caudal angles moderately produced and bluntly rounded, similarly produced but acute in *meleagris*, more decidedly produced and acute in *granulicollis*. Supra-anal plate with margin between the cerci broadly convex. Cerci moderately stout, tapering sharply at extremity to acute apex, in *meleagris* tapering more gradually distad

⁶⁵ Males of these species are compared. We have no material to show the differences which exist between the sexes in the various structural and color features.

⁶⁶ From Saussure's description of the female sex of *granulicollis*, we believe that the pronotum in females of these species will be found to be more heavily granulate, with margins distinctly denticulate.

to the acute apex. Styles of subgenital plate minute, hardly twice as long as wide, in *meleagris* minute but fully three times as long as wide. Cephalic femora with ventro-internal margins showing the following spine formula, I I I I I I I I I I I, the five small successive spines decreasing in length distad with intervals diminishing, as characteristic of the genus. Cephalic tibiae with thirteen and fourteen procumbent external and thirteen and fourteen internal spines on the ventral margins. Median and caudal femora dorso-distad each produced caudad in a lamella which is slightly wider than the caudal tibia.

Color pattern exactly as in *meleagris* except for the absence of the two pale transverse bands found on the pronotum in that species and the reduction of the tegminal markings. Head cinnamon brown, with margins of facial scutellum and proximal antennal joints antimony yellow. Antennae proximad antimony yellow, then briefly cinnamon brown, the entire remaining portions blackish brown. Pronotum cinnamon brown with denticulations and marginal portions, particularly laterad, antimony yellow. Limbs antimony yellow, femora and tibiae and cephalic coxae each with three transverse annuli of equal width which are cinnamon brown, all femora distad and cephalic coxae in addition suffused proximad with cinnamon brown; cephalic metatarsus suffused with cinnamon brown mesad and distad, other metatarsi suffused with cinnamon brown distad, remaining tarsal joints suffused with this color. Tegmina transparent, tinged with green, this heavy proximad, a small spot at base of discoidal field and a comparatively small transverse oval area before the middle of the discoidal field mustard yellow, the latter bounded proximad by a black line which sends one short ray of black into the yellow area; extensor field clear hyaline, colorless. Wings transparent, hyaline, colorless except proximad where they are briefly tinged with dark vinaceous and distad in the anterior field where they are tinged with green, particularly toward the margins.

Length of body 23.5, width of head 4.3, length of eye 2.3, length of pronotum 4.7, greatest pronotal width 3.3, length of tegmen 25, width of tegmen 6, width of tegminal marginal field 1.2, length of abdomen 9.4, greatest abdominal width 5.5, length of cephalic femur 6.8, length of caudal femur 6 mm.

The type of this beautiful little species is unique.

Creobroter meleagris Stål. (Plate II, figure 8.)

1877. *C[reoboter] meleagris* Stål, Ofv. Kongl. Vetensk.-Akad. Förh., 1877, No. 10, p. 39. [♂, ♀; Philippine Islands.]

Los Banos, Laguna, Island of Luzon, Philippine Islands, (from C. F. Baker), 1 ♂.

This specimen agrees fully with Stål's brief description. The species appears to be close to *C. urbana* (Fabricius), but how close we are unable to state, lacking material of that species for the necessary comparison.

In the male before us the eyes project strongly, though not as slender and more divergent than those of the male of *C. granulicollis* Saussure at hand. The conical spine above the ocelli is well developed, the pronotum with surface subgranulate and distinctly quadrilobate in form, the tegmina with proximal spot and ocellate area bittersweet orange, the latter with two black dots proximad, bounded proximad by a broad arcuate black line, distad by a hyaline margin with a similar broad arcuate black line bounding it, the extensor field hyaline, colorless except for a large mesal suffusion of blackish brown.

Length of body 26, width of head 5, length of eye 2.9, length of pronotum 6.1, greatest pronotal width 3.9, length of tegmen 26.8, width of tegmen 6.9, width of tegminal marginal field 1.7, length of abdomen 10, greatest abdominal width 6, length of cephalic femur 9, length of caudal femur 8.7 mm.

***Creobroter episcopalis* Stål.**

1877. *C[reoboter] episcopalis* Stål, Bih. till K. Svenska Vet. Akad. Handl., IV, No. 10, p. 86. [♀, Borneo.]

Labuan Island, British North Borneo, 1 ♀.

This specimen agrees fully with Stål's description, except that it is larger than the type. The sharply conical eyes, lack of spine or denticulation above the ocelli, granulose surface of the pronotum and tegminal markings are particularly noteworthy features.

Length of body 30, length of pronotum 6, greatest pronotal width 3.8, length of tegmen 19.5, width of tegminal marginal field 1.8, length of cephalic femur 7.9, length of caudal femur 6.5 mm.

6TH GROUP, PSEUDOCREOBOTRÆ.

***Theopropus elegans* (Westwood).**

1832. *Blepharis elegans* Westwood, in Griffith, Anim. Kingd., XV, p. 190, pl. LXXVIII, fig. 3. [♀; Tanasserim [error for Tenasserim] Coast.]

British North Borneo, (from Fruhstorfer), 1 ♀.

Sandakan, British North Borneo, (from C. F. Baker), 1 ♀.

Labuan Island, British North Borneo, 1 ♀.

The three specimens of this remarkable species here recorded all agree closely in size, coloration and color pattern.

EXPLANATION OF PLATES.

- PLATE I.—Fig. 1.—*Kongobatha diademata* new species. Queensland, Australia. Female. *Type*. Cephalic aspect of head. ($\times 7$.)
- Fig. 2.—*Kongobatha diademata* new species. Queensland, Australia. Female. *Type*. Latero-external outline of cephalic tibia. ($\times 10$.)
- Fig. 3.—*Polyacanthopus mantispoides* new species. Sandakan, British North Borneo. Male. *Type*. Cephalic aspect of head. ($\times 7$.)
- Fig. 4.—*Polyacanthopus mantispoides* new species. Sandakan, British North Borneo. Male. *Type*. Latero-external outline of cephalic limb. ($\times 6$.)
- Fig. 5.—*Sceptuchus simplex* new species. Singapore, British Straits Settlements. Male. *Type*. Cephalic aspect of head. ($\times 7$.)
- Fig. 6.—*Sceptuchus simplex* new species. Singapore, British Straits Settlements. Male. *Type*. Latero-external outline of cephalic tibia. ($\times 10$.)
- Fig. 7.—*Amantis aeta* new species. Mount Banahao, Luzon, Philippine Islands. Male. *Type*. Cephalic aspect of head. ($\times 7$.)
- Fig. 8.—*Amantis basilana* new species. Island of Basilan, Philippine Islands. Male. *Type*. Cephalic aspect of head. ($\times 7$.)
- Fig. 9.—*Amantis basilana* new species. Island of Basilan, Philippine Islands. Male. *Type*. Latero-external outline of cephalic tibia. ($\times 10$.)
- Fig. 10.—*Tagalomantis manillensis* (Saussure). Los Banos, Luzon, Philippine Islands. Male. Latero-internal aspect of cephalic femur. ($\times 5$.)
- Fig. 11.—*Leptomantis tonkinae* new species. Than-Moi, Tonkin. Female. *Type*. Dorsal view of pronotum. ($\times 6$.)
- Fig. 12.—*Leptomantis tonkinae* new species. Than-Moi, Tonkin. Female. *Type*. Latero-external outline of cephalic tibia. ($\times 10$.)
- Fig. 13.—*Aetaella bakeri* new species. Mount Makiling, Luzon, Philippine Islands. Male. *Type*. Dorsal view of pronotum. ($\times 6$.)
- Fig. 14.—*Aetaella bakeri* new species. Mount Makiling, Luzon, Philippine Islands. Male. *Type*. Latero-external outline of cephalic tibia. ($\times 10$.)

- PLATE II.—Fig. 1.—*Hierodula obiensis* new species. Obi Island, Moluccas. Female. *Allotype*. Dorsal aspect. (Natural size.)
- Fig. 2.—*Hierodula obiensis* new species. Obi Island, Moluccas. Male. *Type*. Dorsal aspect. (Natural size.)
- Fig. 3.—*Hierodula splendida* new species. Haidana, British New Guinea. Male. *Type*. Dorsal aspect of head and pronotum. ($\times 1\frac{1}{2}$.)
- Fig. 4.—*Acromantis luzonica* new species. Baguio, Luzon, Philippine Islands. Male. *Type*. Dorsal aspect of pronotum. ($\times 4\frac{1}{2}$.)
- Fig. 5.—*Acromantis dyaka* new species. Labuan Island, British North Borneo. Female. *Type*. Dorsal aspect. ($\times 2$.)
- Fig. 6.—*Creobroter granulicollis* Saussure. Singapore, British Straits Settlements. Male. Dorsal aspect of pronotum. ($\times 4\frac{1}{2}$.)
- Fig. 7.—*Creobroter labuanae* new species. Labuan Island, British North Borneo. Male. *Type*. Dorsal aspect of pronotum. ($\times 4\frac{1}{2}$.)
- Fig. 8.—*Creobroter meleagris* Stål. Los Banos, Luzon, Philippine Islands. Male. Dorsal aspect of pronotum. ($\times 4\frac{1}{2}$.)
- Fig. 9.—*Amantis aeta* new species. Mount Banahao, Luzon, Philippine Islands. Male. *Type*. Dorsal aspect of pronotum. ($\times 8$.)

March 16.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Forty-six persons present.

The deaths of the following members were announced: Robert E. Peary and Reuben Haines; and Sir James A. Grant, a Correspondent.

MR. STEWARDSON BROWN made a communication on: "Native Orchids of Pennsylvania and New Jersey in the Herbarium of the Academy," and MR. J. FLETCHER STREET exhibited a series of elegantly colored lantern slides of local orchids and associated plants. (No abstracts.)

The following were elected members: J. Franklin McFadden, Lawrence J. Morris, Edward R. Wood, Jr., T. Wistar Brown, 3rd, Hugh F. Munro, Joseph G. Lovering, Frank B. Bower, and Astley P. C. Ashhurst.

The Publication Committee reported the reception of the following papers for publication:

"Scrophulariaceæ of the Southeastern United States," by Francis W. Pennell.

"Mollusca from Central America and Mexico," by Henry A. Pilsbry.

"Notes on New Jersey, Pennsylvania, and Virginia Fishes," by Henry W. Fowler.

"Costa Rican Land and Freshwater Mollusks," by Henry A. Pilsbry.

"Studies in Malayan, Papuan and Australian Mantidæ," by Morgan Hebard.

"Observations on the Soil Acidity of Ericaceæ and Associated Plants in the Middle Atlantic States," by Edgar T. Wherry.

The following was ordered to be printed:

OBSERVATIONS ON THE SOIL ACIDITY OF ERICACEAE AND ASSOCIATED PLANTS IN THE MIDDLE ATLANTIC STATES.

BY EDGAR T. WHERRY.

In a recent paper¹ the writer described the results obtained on a trip in northern New England in June, 1919, where indicator solutions were carried into the field and tests made of the soil reactions of a number of species of Ericaceae and other families of plants thought to be sensitive in this respect.² Both before and since that trip similar observations have been made at a number of places in Pennsylvania and adjoining states, and in the present paper some of the results obtained are described³. The field work has been carried out largely at the writer's own expense, in the course of vacation outings, but funds for certain trips were obtained from the U. S. Bureau of Plant Industry, through Mr. Frederick V. Coville, Botanist of the Bureau.

The regions in which these observations have been made are presented in the following table, with summaries of their dominant geological and soil features. Those in the Appalachian Mountain and Piedmont Provinces are given first, from northeast to southwest, and then those on the Atlantic Coastal Plain, from north to south.

TABLE I.

Features of regions studied.

Locality	State	Surface Geology	Soil Character	Dominant soil reaction ⁴	Ericaceae
<i>Appalachian Mountain and Piedmont. (Alleghanian Zone.)</i>					
Swamps north of Dover.....	N. J.	Siliceous gla- cial drift	Bog and up- land peats	Mediacid	Abundant

¹*Rhodora*, 21:33-49, 1920.

²The use of indicators for this purpose has been described in *Journ. Wash. Acad. Sci.*, 10:217-233, 1920. Sets of indicators for field work are now on the market.

³Southern New Jersey will be discussed in these PROCEEDINGS at a later date.

⁴The terms used for describing soil reactions have been defined in *Journ. Wash. Acad. Sci.*, 9:305, 1919. Specific acidity is the amount of acid, and specific alkalinity the amount of alkali, present in a given solution, with reference to pure water as the unit. Specific acidity between 1 and 10 is called minimacid, between 10 and 100 subacid, between 100 and 1000 mediacid, and above 1000 superacid. Corresponding terms are used on the alkaline side. In addition, minimacid, neutral and minimalkaline reactions are grouped together as circumneutral.

Swamps south of Green Pond..... N. J.	Calcareous glacial drift	Bog and upland peats	Subacid	Common
Mountain ridges in central counties... Pa.	Siliceous rocks	Upland peat some bog peat	Mediacid	Abundant
Valleys in east-central counties..... Pa.	Calcareous rocks	Upland peat	Minimacid	Rare
Uplands in S. E. counties..... Pa.	Various igneous rocks	Upland peat	Subacid	Common
Uplands N. W. of Washington, D. C. Md.	Gneisses, decomposed to clay	Upland peat	Subacid	Common
Mountain ridges eastern counties, W. Va.	Siliceous rocks	Upland peat	Subacid	Common

Coastal Plain. (Carolinian Zone).

Swamps and uplands pine-barrens..... N. J.	Siliceous sands	Bog and upland peats	Mediacid	Abundant
Swamps and uplands marginal areas..... N. J.	Subcalcareous sands, clays	Upland peats	Subacid	Common
Swamps and uplands southern counties... Del.	Siliceous sands	Bog and upland peats	Mediacid	Abundant
Swamps and uplands east of Wash., D. C. Md.	Siliceous sands	Bog and upland peats	Mediacid	Abundant

Grateful acknowledgement is made herewith to those who have acted as guides in several of these places; to Dr. Everett G. Logue and Mr. John P. Young, in central Pennsylvania; Messrs. Harold W. Pretz and Edward S. Mattern, in eastern Pennsylvania; Professor H. Justin Roddy, in southern Pennsylvania; and to Mr. Harry W. Trudell, who has taken part in many of the expeditions, and whose aid in pressing specimens of plants and in many other respects has greatly facilitated the covering of the ground and the obtaining of the data.

DESCRIPTIONS OF INDIVIDUAL LOCALITIES

A. Appalachian Mountain and Piedmont. (Alleghanian Zone.)

SWAMPS NORTH OF DOVER AND SOUTH OF GREEN POND (WARREN COUNTY)
NEW JERSEY.

These two localities in the New Jersey Highlands were selected from the large number available because they are easily accessible and appear to furnish the maximum possible contrast in soil acidity relations. Dover is on the main line of the Delaware, Lackawanna and Western Railroad about 65 kilometers (40 miles) northwest of New York City; Green Pond (one of several bodies of water in New Jersey bearing that name) is two miles east of Bridgeville station, on the "old line" of the same railroad, about 20 km. (12 miles) southeast of Delaware Water Gap. In the swamps 3 km. (2 miles) north of Dover, the country rock is granitic gneiss, and the glacial drift is dominantly siliceous in character, the swamp waters being as a result mediacid. In those south of Green Pond the country

rock, at least of the valley in which the pond lies, is limestone, and the glacial drift contains abundant fragments of calcareous rocks; the pond is fed by springs arising through limestone, so that its water is subalkaline, and similar reactions are shown by the waters at various places in the swamps along the stream draining the pond. Marked differences in flora, in so far as its members are sensitive to soil reaction, would be expected to appear on comparing these two regions.

Ericaceae (used in the broad sense) are actually far more abundant in the Dover region, forming dense thickets; and two of them, *Kalmia latifolia* and *Vaccinium corymbosum*, become small trees. *Clethra alnifolia*, *Eubotrys racemosa*, and *Gaultheria procumbens* may be noted as species which grow here but appear to be absent at Green Pond. Noteworthy members of families other than *Ericaceae* present in some abundance are: *Smilax rotundifolia*, *Habenaria psychodes*, *Coptis trifolia*, *Spiraea tomentosa*, and *Ilicioides mucronata*; all these are absent or rare at Green Pond. To those who are susceptible to *Rhus* poisoning, the Dover swamps will be found far more pleasant than the Green Pond ones, for in the former *R. vernix* and *R. toxicodendron* are very rare.

While the water of the Green Pond swamps is more or less alkaline in reaction, soils of definite and even high acidity are also present there, in the form of hummocks and mounds of decaying vegetable matter mingled with sphagnum and other mosses. On ascending these the reaction becomes less alkaline, passes through neutrality, and often reaches mediacid character at the top. The *Ericaceae* growing in this swamp are exclusively limited to such mounds. The species noted comprise: *Azalea nudiflora* (rare); *A. viscosa*; *Kalmia angustifolia*; *Xolisma ligustrina*; *Gaylussacia baccata* (rare); *Vaccinium corymbosum*; and *Vaccinium macrocarpon*. The soils of these were found to range from mediacid to subacid, their roots apparently not extending into material so moistened by the swamp water as to have less acidity than this. Notable plants of other families showing the same relations are: *Cypripedium acaule*, *Coptis trifolia*, *Menyanthes trifoliata*, and *Linnaea borealis* var. *americana*.

On the other hand there are here a number of plants which grow entirely or chiefly in soils bathed by the alkaline water, and ranging from neutral to subalkaline in reaction. Such are *Cypripedium hirsutum* (reginae), *C. candidum*, *Betula pumila*, *Caltha palustris*, *Par-*

nassia caroliniana, *Rhamnus alnifolia*, and an appalling abundance of *Rhus vernix* and *R. toxicodendron*. All these but the last two seem quite absent from the Dover swamps.

The pitcher plant, *Sarracenia purpurea*, grows in both swamps, in the Green Pond one only in the moss hummocks; and the water in the "pitchers" shows some peculiar reactions. The writer has tested the water held by this plant in many localities, and has found it to be usually mediacid, or subacid, the acidity being no doubt due chiefly to dissolved carbon dioxide. In the Green Pond swamp, however, the water in the pitchers was found to be minimacid, neutral and even minimalkaline. It is possible that the plant may be able to absorb lime from the moss in which it is rooted, and excrete it into the pitcher liquid. It seems more probable, however, that lime is absorbed by the roots of the larch trees, (which are abundant in the Green Pond Swamps, though rare at Dover,) and of other shrubs and trees growing in the alkaline water; and that this lime, excreted upon the leaves of these trees, is washed off by the rain and thus gets into the upturned pitchers.

MOUNTAIN RIDGES IN THE CENTRAL COUNTIES OF PENNSYLVANIA.

Tests have been made of the soils of Ericaceae and other plants at a number of places in the mountains of Pennsylvania, from Scranton on the northeast to Williamsport on the northwest, and from Bethlehem on the southeast to Mont Alto on the southwest. A few of the most interesting localities will be described here in some detail, starting at the northeast end.

The most prominent ridges in the region are underlain by sandstone rocks, and the soils they yield are mostly mediacid to subacid. Lower elevations are occupied by shale rocks, which may also give rise to strongly acid soils. Under circumstances where accumulation of vegetable matter is prevented, the reactions connected with both these rock types may be minimacid to neutral. As an illustration, it may be noted that the fern *Cryptogramma stelleri* (*Pellaea gracilis*) usually described in manuals as a limestone species, was collected at Lincoln Falls, Sullivan County, miles away from any limestone. The rock is a red shale (of Devonian age) and the water oozing from it is neutral in reaction.

At South Stroudsburg the Rhododendron nursery of W. K. Labar was visited, and the methods of growing ericaceous plants there were kindly demonstrated by Mr. John van Kleef, the resident manager. The natural soil of this place is a calcareous glacial

drift, averaging minimacid in reaction. A few Ericaceae, notably *Rhododendron maximum* and *Kalmia latifolia*, grow there naturally, and it has been found possible to introduce many other species. The acidity found seems rather low, judging from what has been observed in the course of these studies, for these plants to make the best growth, but peaty material of somewhat more acid reaction—subacid—is being brought from the Pocono region, and mixed with the native soil, the result being highly satisfactory. At most other places within the glaciated area the drift is dominantly siliceous, and the soil reactions more strongly acid, Ericaceae being widespread and abundant at many points.

It was particularly desired to obtain data as to the behavior of ericaceous plants at or near a contact of a siliceous rock with a limestone; and one such locality was found, near the country club, some 3 km. (2 miles) east of Williamsport, Lycoming County. Near the main road (from Williamsport to Montoursville) there is an old limestone quarry; on the waste ground around it is a dense thicket of various shrubs bearing small, juicy fruits; the call of catbirds from the thicket suggesting how these shrubs may have been introduced. There were one or more species of *Celtis*, *Prunus*, *Crataegus*, *Rhus*, *Celastrus*, *Sambucus*, etc., present; but in spite of thorough search, not a single member of the Ericaceae could be found, although colonies of these plants, from which the birds no doubt obtain much food, are present within a few hundred meters. Evidently the seeds of the Ericaceae, when they fall into the limestone soil, either do not germinate at all, or if they do, the young plants soon succumb. Tests of the soil showed its reaction to vary from neutral to minimalkaline.

Going north from this quarry, around the end of a golf course, the limestone rock gives way to shale and this in turn to sandstone, a thin oak woods spreading over the contacts of these formations. As the limestone is receded from, the soils become more and more acid, and Ericaceae gradually appear. The first species was found to be *Vaccinium vacillans*; its soil proved to be minimacid. *Gaylussacia baccata* and *Azalea nudiflora* come in a short distance further on; their soils being minimacid to subacid. On reaching the sandstone formation Ericaceae appear in abundance, the above mentioned species being still present, and in addition *Kalmia latifolia*, *Gaultheria procumbens*, *Epigaea repens* and *Vaccinium corymbosum*. Various species of pine trees, and other acid soil plants, such as *Lupinus perennis*, come in here also; and tests of the soi-

showed subacid to mediacid reaction. The control of the distribution of Ericaceae by the soil reaction is here so evident as to require no further comment.

No other localities in the mountain region need special description, the acidities of the soils of Ericaceae observed there being included below, but the data which have been obtained on a few plants of other families than Ericaceae may be added here. The following were found to be limited to mediacid or occasionally subacid soils: *Clintonia borealis*, *Trillium erythrocarpum*, *Tiarella cordifolia*, *Dalibarda repens*, *Waldsteinia fragarioides*, *Oxalis acetosella*, *Polygala paucifolia*, and *Trientalis borealis*. In circumneutral soils, rarely ranging to subacid, characteristic plants are: *Cryptogramma stelleri* (*Pellaea gracilis*), *Filix fragilis*, *F. bulbifera*, *Camptosorus rhizophyllus*, *Allium tricoccum*, *Aquilegia canadensis*, and *Castilleja coccinea*. Wide range of reaction is shown by *Taxus canadensis*, *Trillium erectum*, *Clematis verticillaris*, *Hepatica acutiloba*, *Viola pedata*, etc. Finally it may be noted that *Phlox subulata*, while its acidity range is wide, shows more or less correlation of flower-color with soil reaction, in that the deep rose-violet flowered plants are usually found to grow in soil of lower acidity than those with pale rose or white flowers. There are, of course, cases in which both grow in close association, and where this relation does not hold, but in general it seems to be fairly definite.

VALLEYS IN EAST CENTRAL COUNTIES OF PENNSYLVANIA

The Lehigh-Lebanon valley of eastern Pennsylvania is largely underlain by limestone rocks, but at many places there is a thin layer of glacial drift over the limestone. The soil reactions associated with such a geological relationship and the resulting distribution of Ericaceae are matters of considerable interest. Tests have shown that the soil of unprotected limestone rock is normally minimalkaline or neutral in reaction; but that where the glacial drift occurs, upland peat tends to develop, often reaching a minimacid and occasionally even as high as subacid reaction. Woods in which many acid soil plants grow can develop in such drift-covered places, but where these woods are cut over and the acid upland peat material is given a chance to decompose, the acidity may decrease decidedly. No doubt under such circumstances those species which require the most acid conditions die out rapidly, while those which can adapt themselves to a less degree of acidity persist for some time, even to the point where the reaction goes down to the neutral point.

In the "Big Woods," about 6.5 km. (4 miles) southwest of Allentown, Lehigh County, Pa., the drift covering is thick enough to permit the growth of pine trees, and tests have shown the soil acidity of the upland peat to range from subacid down to minimacid. Here were noted the Ericaceae: *Pyrola americana*, *Chimaphila maculata*, *C. umbellata*, *Gaylussacia baccata*, and *Vaccinium stamineum*. In addition *Cypripedium acaule* and *Viola pedata*, regarded as acid soil plants, thrive here.

Some 5 km. (3 miles) northwest of this point is a small knoll formerly occupied by similar woods, but cut over several years ago. The humus has been extensively destroyed, and the soil acids neutralized by the underlying limestone, so that the acidity at present is minimacid, but the following Ericaceae have persisted: *Azalea nudiflora*, *Gaylussacia baccata*, *Vaccinium stamineum*, *V. vacillans*, and *V. corymbosum*. With these are *Comptonia asplenifolia* (*peregrina*) and *Viola pedata*, the soil of the last in some cases reaching actual neutrality, a rather unusual occurrence. (This observation was made in early spring; later in the season slight acidity may develop there).

Similar relations have been observed at some five localities, and are no doubt present at other places through this limestone valley, but nowhere have Ericaceae or other plants usually limited to highly acid soils been found to grow in the neutral to subalkaline soils of the limestone itself.

HILLS IN SOUTHEASTERN COUNTIES OF PENNSYLVANIA.

Describing in this province, as in previous ones, only particularly interesting occurrences, mention may first be made of a contact of sandstone and limestone at Fruitville, Lancaster County. On the sandstone, where the soils range in acidity from mediacid down, Ericaceae such as *Azalea nudiflora*, *Gaylussacia baccata*, *Vaccinium stamineum*, and *V. vacillans* are abundant. On passing over the contact toward the limestone side, these gradually die out, but two of them, the *Gaylussacia* and *Vaccinium vacillans*, extend into limestone soil of neutral reaction. It should be noted, however, that these plants are there stunted and obviously not thriving; and they are absent entirely when the soil becomes actually alkaline.

Thus far acidity data have been given chiefly for sandstone and limestone, so it may be of interest to add what has been observed, in the present region, about other formations. Mica schist and mica gneiss seem to yield normally subacid reactions. Trap rock (diabase).

in spite of a rather high content of alkali and alkaline earth metals,—sodium, calcium, magnesium,—gives mostly subacid to minimacid soils. Serpentine behaves similarly, and subacid or even mediacid soils often develop, in spite of the magnesium content. The red shale formation of Triassic age, which covers a wide area in this part of Pennsylvania, yields subacid soils in many places, but since some of its strata contain considerable calcium carbonate, minimacid, neutral, and even minimalkaline soils are at times present upon it. The abundance of *Ericaceae* on these several formations has been found to follow closely the development of soils of subacid or mediacid reaction.

HILLS NORTHWEST OF WASHINGTON, D. C.

On coming further south, the rocks are mostly more fully decomposed than they are in Pennsylvania, and the alkali metals are more extensively leached out, so that hills are often covered with dense clays, showing but little similarity to the original rocks. Subacid soils have been found to be dominant in such situations, and *Ericaceae* accordingly fairly common. Along the Potomac Valley northwest of Washington, D. C., the clays are considerably eroded, and the solid rock exposed; but here a secondary factor influences the soil reaction. The Potomac River and its tributaries flow for long distances through limestone regions, and take up considerable amounts of calcium bicarbonate. Not only does this make the waters themselves minimalkaline, but the sands and muds deposited at flood times also contain so much calcareous matter as to render the soils there circumneutral in reaction. Accordingly the *Ericaceae*, which grow on the uplands, drop off markedly as the level of river deposition is approached, and circumneutral-soil plants are common at the lower levels.

MOUNTAIN RIDGES OF WEST VIRGINIA.

In the mountains of West Virginia, conditions are similar to those in the corresponding regions of Pennsylvania. The *Ericaceae* characteristic of the southern Appalachian Mountains reach their northern limits there, but they have not been found to show on the whole any differences in soil acidity from the *Ericaceae* which also grow farther north. The upland peat of the great *Rhododendron* thickets is mediacid to subacid in reaction, the plant roots usually extending down into material of the lesser acidity. The reactions of the soils of individual species are listed below.

B. Coastal Plain. (Carolinian Zone.)

PINE BARRENS AND MARGINAL AREAS OF NEW JERSEY.

The correlation between soils and plants in southern New Jersey will be discussed by the writer elsewhere. The following is a summary of the conclusions there reached.

As every botanist interested in plant distribution has undoubtedly become acquainted with Stone's "Plants of Southern New Jersey," no description of the plants of this region need be given here. As to soils, although pure quartz sand should react neutral toward indicators, that of the Pine-barren area seems to be always more or less acid, no doubt owing to the accumulation of invisible humus matter between the grains; and where the humus is prominent, the reaction is usually mediacid, so that the Pine-barren area can be regarded as essentially a vast expanse of highly acid soils. On digging down through the surface layers of these soils, the acidity gradually decreases, and at a depth of three or four decimeters may be minimacid. Road-cuts and stream valleys through the region readily reach the levels of lower acidity, and on their banks grow plants which do best under somewhat less acid conditions, *Asplenium platyneuron* being a typical example.

The upper part of the Middle District or Marl area differs from the Pine-barren area in that mediacid soils are comparatively rare, the sands containing greater amounts of compounds of calcium and other elements which tend to neutralize more or less such acids as develop. The strata of Cretaceous age which outcrop are well known to contain considerable calcium carbonate derived from fossil shells, and the soil has in fact been found to reach neutral or even minimalkaline reaction in certain places, as for instance, the Lindenwold bog. In the Cohansey and Cape May areas the acidity also averages low, the source of the lime appearing to be sediments deposited in Quaternary times by the Delaware River, which drains vast areas of limestone rocks in its upper reaches, and the water of which is today slightly alkaline. In the Coastal area the sandy soils are mediacid as in the Pine-barrens, but contain considerable sodium chloride, calcium sulfate, etc., so that plants which require high content of salts, but are indifferent to acidity as such, together with those which require acidity but are tolerant of salts, are characteristic of this area.

The distribution of plants is evidently controlled to a marked degree by these features of the soils. As Stone remarks "The Pines seem to be the chosen land of the Ericaceae, which abound

there both in species and individuals."⁶ Many ericaceous species which are shown by studies in other regions to prefer mediacid or high subacid soils thrive in the Pine-barrens, whereas those requiring less acid conditions, such as the *Pyrolas* and *Chimaphilas*, are there infrequent, rare or unknown. On the other hand, plants which in the north are regarded as "calciphiles"—circumneutral soil plants—extend into southern New Jersey only along the marginal regions. To give but one example, *Gentiana crinita* is, as noted by Stone, a rarity in southern New Jersey; but in the Lindenwold bog it grows in wonderful abundance, being limited to the lower levels, where the calcareous strata outcrop, and neutralize the soil.

SOUTHERN DELAWARE.

During March, 1919, the writer visited the region around Millsboro, Sussex County, Delaware, to study the soil acidity as related to the distribution of native plants. The selection of this particular place was due to the reported occurrence there of the box-leaved huckleberry, *Gaylussacia brachycera* (Michx.), of which living specimens were desired. The earliness of the trip was determined by the fact that this plant is an evergreen and seemed likely to be most readily found before the leaves had developed on the majority of other plants. After several days' search a single small colony of the *Gaylussacia* was located, many acidity tests of the soils met with being carried out in the course of the trip. The results of these studies are here presented; since this region is less well known than those previously described, it is treated in greater detail.

The Millsboro region lies on that part of the Atlantic Coastal Plain known as the Delaware Peninsula or "Eastern Shore" (of Chesapeake Bay) District, about 16 km. (10 miles) back from the sea coast, and a like distance from the southern boundary of the state of Delaware. It is best reached by train on the Franklin City branch of the Delaware, Maryland and Virginia Railroad, a part of the Pennsylvania system, running south from Wilmington, Delaware. It is a region of low relief, the Indian River, which traverses it, being a tidal estuary, while the maximum elevation is little over 12 meters (40 feet) above sea level. The geological formation exposed at the surface of the ground is the Talbot formation, of Pleistocene age, consisting of unconsolidated sand, with occasional lenses of gravel and of clay, and the soils correspond in character.

⁶The Plants of Southern New Jersey. . . . Trenton, 1911, p. 617.

The growing season, or interval between average dates of minimum temperatures of 0° C (32° F.), is about 200 days in length.

The region around Millsboro is farmed extensively, but the native vegetation is preserved here and there, especially along the banks of streams. The dominant tree is *Pinus taeda*, and mingled with it are *P. serotina*, *P. echinata*, *P. rigida*, and *P. virginiana*. Oaks, maples, and gums are the principal deciduous trees. In the swamps occur *Chamaecyparis thuyoides* and rarely *Taxodium distichum*. A striking feature of the pine forests is the sparsity of the undergrowth, in which they resemble the southern rather than the New Jersey Pine-barren regions.⁶

The most prominent smaller trees and shrubs include *Myrica caroliniensis*, *Magnolia virginiana*, *Alnus rugosa* and the southern species *A. maritima*, *Ilex opaca*, *I. glabra*, *Pyrus* (*Aronia*) *arbutifolia*, *Aralia spinosa*, *Cornus florida*, and some 15 ericaceous plants, divisible into two groups: those of mediacid, and those of subacid soil. The mediacid soil species which mostly grow in swamps, are: *Clethra alnifolia*, *Azalea viscosa*, *Kalmia angustifolia*, *Eubotrys racemosa*, *Xolisma ligustrina*, *Gaultheria procumbens* and *Vaccinium corymbosum*. The *Gaylussacia brachycera* itself grows in dry upland peat with mediacid to high subacid reaction. The species more characteristic of dry subacid soils are: *Chimaphila maculata*, *C. umbellata*, *Azalea nudiflora*, *Kalmia latifolia*, *Epigaea repens*, *Gaylussacia baccata*, and *Vaccinium vacillans*.

Mediacid reaction was found to be present practically throughout the swamps, both in the water and the peat, and also in upland peat of the dry hills. On digging down into the sand beneath such upland peat, the acidity was found to decrease markedly, the measurements being: Surface, specific acidity 300; 25 centimeters down, 100; 50 cm. down, 30; and 100 cm. down, 10. As in the New Jersey Pine-barrens, both natural and artificial depressions often show the lower acidities on their banks, which relation controls to a certain extent the distribution of plants.

Two plants were observed to grow in this region which are elsewhere characteristic of circumneutral soils, *Asplenium platyneuron* and *Aquilegia canadensis*. The first appears chiefly in isolated patches in the pine woods, where either because of the presence of bacteria able to decompose the acid constituents of the upland peat,

⁶Compare Harper, *Bull. Torrey Bot. Club*, 37: 426, 1910; *Bull. Geogr. Soc. Phila.* 16: 14, 1918.

or of lenses of calcareous clay, the acidity of the soils is markedly diminished. These areas, mostly only a few meters in diameter, and more or less circular in outline, are scattered through the woods, forming in a sense oases in the desert; with the exception of *Chimaphila maculata*, the Ericaceae appear to avoid them. Wherever *Asplenium* showed up in the forest floor,—and it was very prominent, the fronds attaining lengths of as much as 40 cm.,—tests invariably showed the area it occupied to be subacid or circumneutral in reaction. Presumably the spores of this fern are killed when they fall into the more acid soils of the region.

The *Aquilegia*, together with a few plants of *Asplenium*, was observed in quite a different habitat, namely, on the steep banks of the Indian River. The low acidities observed were in this case obviously connected with the fact that the plant roots entered directly the lower layers of the soil, which are everywhere less acid than the surface portions. *Epigaea repens* was also found to grow on the same banks, but its roots do not enter the low acid sands to any extent, being instead imbedded in superficial peaty material with the usual mediacid reaction.

Another type of relationship is shown by *Yucca filamentosa*, the optimum for which appears to lie at specific acidity 30. This plant grows, apparently as a native and not an escape, in large patches in the more open pine woods, where the surface soil is upland peat with mediacid reaction. It has, however, an erect underground stem 25 or more cm. long, at the base of which is a cluster of tuberous roots, with fibrous ones extending downward from them. As far as its root system is concerned, therefore, this species is growing not in highly acid, but in subacid soils.

REGION EAST OF WASHINGTON, D. C.

The region east of Washington is so similar to the New Jersey and Delaware areas already discussed that little need be said about it at this point. Plant distribution is elaborately treated in a recent publication.⁷ The magnolia bogs as therein defined are dominantly mediacid in reaction, and the upland peat of the dry surrounding hillsides attains the same acidity, so that Ericaceae and their usual associates abound in both habitats. Subacid and rarely minimacid soils occur on banks and locally through the woods, and support a few plants which can not stand the higher acidities.

⁷McAtee, W. L. A sketch of the Natural History of the District of Columbia, *Bull. Biol. Soc. Wash.*, 1: 142 pp., 1918.

Many tests made in this region are included in the tables for individual ericaceous species which follow.

OBSERVATIONS ON INDIVIDUAL SPECIES

In order to bring out the acidity relations of the individual species, the plan suggested in the paper above cited^a has been modified in such a manner that while the specific acidities are plotted horizontally the number of places where each value has been observed are now plotted vertically. Thus, on p. 97, when a given species has been found to grow in a soil with specific acidity = 100 at two different localities (or distinctly different habitats in the same locality) an x is placed above the figure 100 and opposite the number 2. Observations in nurseries are marked with n , and those made in other regions, which seem worth introducing for comparison, with o . A curve may be regarded as drawn through the points thus marked, and from its shape the behavior of the plant with respect to soil acidity may be seen at a glance. In most Ericaceae the curves indicate that there is a definite limit to growth on the less acid side, and sometimes on the more acid side as well. There is also in most cases a maximum in the curve,—an intermediate point—at which the species is observed to grow with such frequency and luxuriance that this value is to be regarded as its optimum reaction under natural conditions.

Each species has been examined, on the average, at 10 localities selected so as to show as wide a range of conditions as possible. Tests have been made at each locality in sufficient number to insure the records being typical of the occurrence. Identifications of the plants have been made with care, specimens of each being preserved, and in cases of uncertainty submitted to authorities on the groups concerned. While freely admitting that there is room for additional data from other regions the writer feels that in most cases observations enough have been made to justify accepting with some degree of confidence the definiteness of the optimum and limiting reactions indicated.

The American code of Nomenclature is followed for the most part; but the genus-splitting favored in Britton and Brown's "Illustrated Flora" and the "North American Flora" is not accepted.

^a*Rhodora*, 21: 43 1920.

Clothra alnifolia L.

Habitat.—Wet sphagnum peat and occasionally dry upland peat at swamp margins.

Acidity.—

5+	x				
4					
3					
2		x			
1			x	n	
	300	100	30	10	3
	Mediacid		Subacid		Miniacid
					1
					Neutral*

The optimum soil reaction for this species is obviously mediacid. The lower values sometimes observed represent places where the plant pushes out from its usual swamp habitat into dry sandy woods. The *n* in the table refers to a test of sandy soil in Gillett's nursery at Southwick, Massachusetts, and is introduced to show that this plant can be grown under cultivation in a soil of somewhat lower initial acidity than it appears to occupy in nature.

Pyrola americana Sweet.

Habitat.—Dry upland peat and occasionally moist peat at swamp margins.

Acidity.—

5+			x			
4						
3				x		
2						
1	x	x			x	
	300	100	30	10	3	1

The optimum soil reaction for this species is subacid. The most acid reaction tabulated was observed in moist peat at the margin of a swamp north of Dover, N. J. The least acid was noted in upland peat on glacial drift overlying limestone in the Lehigh Valley west of Allentown, Pa.

Pyrola elliptica Nuttall.

Habitat.—Dry and occasionally moist upland peat.

Acidity.—

5+					
4			x	x	
3				o	
2			o		o
1	300	100	30	10	3

^aIn the succeeding tables these names are omitted for brevity. Their use in the text will be understood to imply the same degree of acidity here indicated.

The optimum soil reaction of this species is probably between subacid and minimacid; the tests made on it in New England, indicated by o's, led to the same value.

***Pyrola secunda* L.**

Habitat.—Dry and occasionally moist upland peat.

Acidity.—

5+			x			
4				x		
3			o			
2				o		
1		x			o	
	300	100	30	10	3	1

The optimum soil reaction of this species is inferred, from consideration of the data from both New England and the present region, to be subacid. The most acid reaction tabulated was observed in sandy upland peat in southern Delaware.

***Chimaphila maculata* (L.) Pursh.**

Habitat.—Dry upland peat.

Acidity.—

5+			x			
4						
3						
2				x	x	
1	x	x				
	300	100	30	10	3	1

The optimum soil reaction of this species is subacid. The most acid reaction was observed in sandy upland peat in southern Delaware. The least acid was noted in upland peat on glacial drift overlying limestone in the Lehigh Valley west of Allentown, Pennsylvania, and in upland peat over limestone at Natural Bridge, Virginia.

***Chimaphila umbellata* (L.) Nuttall.**

Habitat.—Dry upland peat.

Acidity.—

5+			x			
4						
3						
2			o	x		
1	x	x		o		
	300	100	30	10	3	1

The optimum soil reaction of this species is subacid. The most acid reaction was observed in sandy upland peat in southern Delaware.

***Monotropa uniflora* L.**

Habitat.—Dry and occasionally moist upland peat.

Acidity.—

5+			x			
4						
3						
2				x		
1		x				
	300	100	30	10	3	1

The optimum soil reaction of this species is subacid; its range is apparently rather more limited than those of preceding members of the Ericaceae. The most acid reaction was noted in sandy upland peat in southern Delaware; the least acid in clayey upland peat at two widely separated localities near Washington, D. C.

***Hypopitys lanuginosa* (Michx.) Nuttall**

Habitat.—Dry and occasionally moist upland peat.

Tests have been made on *Hypopitys* chiefly during the winter, and the species could not be accurately determined. Plants approaching *H. lanuginosa* in characters have been examined at two localities near Washington, D. C., in clayey upland peat, and yielded subacid reaction in both cases.

***Hypopitys americana* (De Candolle) Small.**

Habitat.—Dry upland peat.

Plants probably referable to *H. americana* have been examined near Dover, N. J., the soil being sandy upland peat over glacial drift, and the reaction subacid.

***Azalea nudiflora* L.**

Habitat.—Dry upland peat and occasionally wet sphagnum peat.

Acidity.—

5+			x			
4				x		
3						
2						
1		x	x		x	
	300	100	30	10	3	1

The optimum soil reaction of this species is subacid. The most acid reaction tabulated was observed in a swamp in southern Delaware; the least acid in upland peat over calcareous glacial drift near Green Pond, N. J.

***Azalea canescens* D. Don.**

Habitat.—Dry upland peat.

This species has been observed but rarely, in the mountains of central Pennsylvania; the soil in these cases is upland peat over sandstone rocks, and the reaction subacid or rarely mediacid.

Azalea arborescens* Pursh.Habitat*.—Moist upland peat.

This species has been observed in the mountains of eastern central West Virginia, chiefly in Tucker county. The soil is moist upland peat, and the usual reaction subacid.

Azalea viscosa* L. (Including varieties *glauca*, *nitida*, etc.)Habitat*.—Wet sphagnum peat and occasionally dry upland peat at swamp margins.*Acidity*.—

5+	x					
4						
3						
2						
1						
	300	x 100	x 30	n 10	3	1

The optimum soil reaction for this species is mediacid. The lower values noted represent places where the plant pushes out from its usual swamp habitat into dry sandy woods. The *n* in the table refers to Gillett's nursery at Southwick, Massachusetts. This makes with the preceding plant a pair of closely related species with marked dissimilarity in optimum soil reaction.

Rhododendron maximum* L.Habitat*.—Moist and occasionally dry upland peat and wet sphagnum peat.*Acidity*.—

5+			x			
4						
3	x					
2		x		x		
1					x 3	x 1
	300	100	30	10		

The optimum soil reaction for this species appears to subacid, but its range is unusually wide. The most acid reaction tabulated represents occurrences in sphagnum peat in a swamp in central Lycoming County, Pa., and in moist upland peat in the mountains of West Virginia. The two least acid values were observed in upland peat on calcareous glacial drift east of Williamsport, Pa. While some of the roots of these plants were found to be surrounded by soils of these acidities, other roots of the same plants were in subacid soils. Seedlings have been found most frequently in subacid soils.

Menziesia pilosa* (Michaux) Persoon.Habitat*.—Dry and occasionally moist upland peat.

This species has been observed only on Spruce Mountain and neighboring ridges in Pendleton County, West Virginia. The soils are upland peats over sandstone rocks, and the reaction is subacid to mediacid.

***Dendrium buxifolium* (Berg) Desvaux.**

Habitat.—Moist and occasionally dry sand, and wet sphagnum peat.

This species has been observed at various places in central and southern New Jersey, being especially prominent in the Pine-barrens. Its soils show in practically every case a mediacid reaction, rarely approaching subacidity. In its typical occurrences in white sand, this acidity appears to be due to the presence of autogenous humus, that is, humus formed by the decomposition of the leaves of the plant itself.

***Kalmia latifolia* L.**

Habitat.—Dry upland peat and wet sphagnum peat.

Acidity.

5+				x		
4		x				
3			x			
2						
1						
	300	100	30	10	3	1

The optimum soil reaction of this species is probably subacid, but it is of frequent occurrence in mediacid soils too. The lowest acidity tabulated was noted in upland peat over calcareous glacial drift near Stroudsburg, Pa. Seedlings have been observed most frequently in subacid soils.

***Kalmia angustifolia* L.**

Habitat.—Wet sphagnum peat, moist and dry upland peat, and dry sand.

Acidity.—

5+		x				
4						
3			x	x		
2		o	o			
1			o	n		
	300	100	30	10	3	1

The optimum soil reaction of this species is probably mediacid, but it is also frequently found in subacid soils. In northern New England it is most often met with in mediacid peat, and seedlings have been observed only in such material. Subacid reactions have

been noted in upland peats in the Pennsylvania mountains, and in gravel in the Saucon Valley, eastern Pennsylvania, as well as in Vermont. And as indicated by the *n* in the table, it can be grown under cultivation in soils of as low an acidity as minimacid.

***Eubotrys racemosa* (L.) Nuttall.**

Habitat.—Wet sphagnum peat, wet and dry upland peat.

Acidity.—

5+						
4	x	x	x			
3						
2						
1				x		
	300	100	30	10	3	1

The optimum soil reaction of this species is probably subacid, although it is also rather frequent in mediacid soils. The least acid reaction listed was observed in an occurrence in dry upland peat on schistose rocks northwest of Washington, D. C.

***Neopleris mariana* (L.) Britton.**

Habitat.—Dry upland peat and occasionally moist peat.

Acidity.—

5+						
4	x					
3						
2						
1		x	x			
	300	100	30	10	3	1

The optimum soil reaction of this species is probably mediacid. The least acid reaction tabulated was observed in dry sand south of the New Jersey Pine-barrens.

***Xollisma lignustrina* (L.) Britton.**

Habitat.—Dry upland peat and wet sphagnum peat.

Acidity.—

5+						
4	x		x			
3		x				
2						
1				x		
	300	100	30	10	3	1

The optimum soil reaction of this species is probably subacid, although it is also of frequent occurrence in mediacid soils. The least acid value tabulated was noted in dry upland peat on calcareous glacial drift near Green Pond, New Jersey.

***Chamaedaphne calyculata* (L.) Moench.**

Habitat.—Wet sphagnum peat and occasionally dry upland peat.

Acidity.—

5+	x						
4							
3			x				
2			o				
1							
	300	100	30	10	3	1	

The optimum soil reaction of this species is probably mediacid. The lowest acidities tabulated, marked *o*, represent an occurrence south of Willoughby Lake, Vt., where the plant grows at the margin of an alkaline water pond, and its roots push out as far as material of this acidity. It is also grown in nurseries in dry sandy soil between subacid and minimacid in reaction.

Oxydendrum arboreum (L.) DeCandolle.

Habitat.—Dry upland peat.

As observed in southern Virginia, this plant grows in woods where the surface soil is mediacid, but its roots usually extend down into material of subacid reaction.

Epigaea repens L.

Habitat.—Dry upland peat and occasionally moist peat.

Acidity.—

5+			x				
4	x						
3		x					
2				x			
1							
	300	100	30	10	3	1	

The optimum soil reaction of this species is probably subacid, although it is fairly common in mediacid soils as well. The least acid reactions tabulated were observed in upland peats near Washington, D. C. The most heavily fruiting plants and the most numerous seedlings have been found in subacid soils.

Gaultheria procumbens L.

Habitat.—Dry and moist upland peat, and wet sphagnum peat.

Acidity.—

5+	x						
4							
3							
2		x	x				
1				o			
	300	100	30	10	3	1	

The optimum soil reaction of this species is probably mediacid, although it is fairly common in subacid soils as well. The least acid reaction (*o*) was observed in upland peat on calcareous glacial drift near Fairlee, Vt.

Arctostaphylos uva-ursi L.

Habitat.—Dry upland peat.

This species has been observed at two widely separated localities in the Pine-barrens of New Jersey, in upland peat and in white sand rendered acid by autogenous humus, the reaction being medi-acid. A soil sample from a colony growing on trap rock in south central Connecticut, kindly submitted by Mr. C. A. Weatherby, proved to be subacid. On the other hand, it is reported by Fernald¹⁰ from cliffs of limestone at Bic, Quebec; and Mr. Coville informs the writer that he has collected it on limestone north of Lake Superior. In both these occurrences the soils are presumably at most minim-acid, if not neutral or alkaline, which would indicate that the species has a wide range of soil reaction.

In the Alps something of the same sort has been noted. According to Schroeter:¹¹

"In Wallis it is according to Jaccard calciphilous, likewise in the Bavarian Alps according to Sendner, while Contejean designates it as calciphobous, and Mangin and Lecoq as indifferent. According to my experience it is calciphilous in the Swiss Alps." Yet Warming¹² includes it among oxylophytes or acid soil plants. Further study of this plant is desirable to ascertain whether there are any varietal differences associated with these divergences of soil reaction.

Chloignes hispidula (L.) T. & G.

Habitat.—Moist and occasionally dry upland peat and wet sphag-num peat.

Acidity.—

5+	x					
4						
3						
2	o	x				
1		x				
	300	100	30	10	3	1

The optimum soil reaction of this species is mediacid, which has been obtained at stations in the mountains of Pennsylvania and West Virginia, as well as in northern New England. It is interesting to note that Thoreau¹⁴ pointed out that the Indian name for this plant means "grows where trees have rotted," rotting wood being usually strongly acid in reaction.

¹⁰*Rhodora*, 9: 163, 1907.

¹¹*Das Pflanzenleben der Alpen*, Zürich, 1908; p. 156.

¹²*Oecology of plants*, Oxford, 1909; page 211.

¹⁴"The Maine Woods."

Gaylussacia brachycera (Michx.) Gray.

Habitat.—Dry upland peat.

This species has been studied at the two stations known at present, New Bloomfield, Pa., and Millsboro, Del.¹⁵ In both places the dominant soil acidity around its roots is mediacid, ranging to subacid here and there. At the Pennsylvania locality the underlying clayey soil (derived from disintegration of Devonian shale) is lower than this in acidity, being minimacid, but the plant tends to avoid the raw soil, and to grow most profusely wherever vegetable matter is in course of decay. It follows especially the courses of old fallen tree trunks, (and stumps), which are thereby outlined in green against the dominant brown of the surrounding soil. In the Delaware colony the underlying soil is white sand rendered mediacid by admixture of humus and covered by a thick carpet of upland peat made up of *Kalmia* leaves and pine needles; and the plant grows in a single compact mat, some 20 feet in diameter, being apparently prevented by climatic conditions or by some parasite from spreading into similar soil surrounding the area.

Gaylussacia dumosa (Andrews) T. & G.

Habitat.—Wet sphagnum peat.

This species has been observed in but two regions, the New Jersey Pine-barrens and the Coastal Plain swamps east of Washington, D. C. The dominant soil reaction in both places is mediacid.

Gaylussacia frondosa (L.) T. & G.

Habitat.—Wet sphagnum peat, moist and dry upland peat.

Acidity.—

5+							
4		x					
3							
2							
1			x	x			
	300	100	30	10	3	1	

The optimum soil reaction of this species is mediacid. The lowest acidity tabulated was observed in dry woods south of the New Jersey Pine-barrens.

Gaylussacia baccata (Wang.) Koch.

Habitat.—Dry and moist upland peat and occasionally wet sphagnum peat.

¹⁵*Science*, 50: 30-34, 1919.

Acidity.—

5+			x			
4				x		
3						
2	x	x				
1					x	x
	300	100	30	10	3	1

The optimum soil reaction of this species is subacid. The most acid reactions tabulated were observed in swamps north of Dover, N. J., and in southern Delaware. The least acid was noted in Lancaster County, Pa., at the contact of sandstone and limestone formations, this *Gaylussacia*, along with one *Vaccinium*, extending a short distance over on to the limestone side.

Vaccinium stamineum L.

Habitat.—Dry and occasionally moist upland peat.

Acidity.—

5+			x			
4				x		
3						
2						
1		x			x	
	300	100	30	10	3	1

The optimum soil reaction for this species is subacid. The least acid reaction tabulated was observed in upland peat on decomposed diorite-gneiss rock southwest of Allentown, Pa.

Vaccinium pennsylvanicum Lamarck.

Habitat.—Dry and occasionally moist upland peat.

Acidity.—

5+			x			
4						
3	x					
2		x		x		
1	o	o				
	300	100	30	10	3	1

The optimum soil reaction for this species is apparently subacid. In the White Mountains (indicated by the *o* in the table) its soils are mediacid, but the plant there is distinct in several respects from the one found in the Middle Atlantic States. In Gray's Manual this northern form is distinguished (as var. *angustifolium* (Ait.) Gray). The lowest acidities tabulated were observed near Wilkes-barre, Pa., and on a sample of soil kindly submitted by Professor George S. Perry of the Pennsylvania Forest Academy from near Mont Alto.

Vaccinium vacillans Kalm.

Habitat.—Dry and occasionally moist upland peat.

Acidity.—

5+			x			
4				x		
3						
2	x	x			x	x
1						
	300	100	30	10	3	1

The optimum soil reaction of this species is subacid. The least acid reaction tabulated, actual neutrality, was observed in Lancaster County, Pa., at the contact of sandstone and limestone formations, this species extending over onto the limestone. At other contacts it is one of the earliest of the Ericaceae to appear as the limestone is receded from.

Vaccinium corymbosum L.

Habitat.—Wet sphagnum peat and moist and occasionally dry upland peat.

Acidity.—

5+	x		x			
4						
3		x				
2				x		
1					x	
	300	100	30	10	3	1

The optimum soil reaction of this species is probably subacid, although it is common in mediacid soils as well. The lowest acidities tabulated were observed in the Lehigh Valley west of Allentown, Pa., in upland peat on glacial drift overlying limestone.

Vaccinium aroccocum (A. Gray) Heller.

Habitat.—Wet sphagnum peat and moist and occasionally dry upland peat.

Acidity.—

5+						
4						
3						
2			x	x		
1						
	x	x			x	
	300	100	30	10	3	1

The optimum soil reaction of this species is probably subacid. The lowest acidity tabulated was observed in upland peat on glacial drift overlying limestone in the Lehigh Valley west of Allentown, Pa.

Vaccinium erythrocarpum Michaux.

Habitat.—Moist and dry upland peat.

This species has been observed only in the mountains in Pendleton County, West Virginia. The soil acidity was found to be mediacid in most cases, occasionally ranging to subacid.

Vaccinium oxycoccus L.

Habitat.—Wet sphagnum peat.

In addition to occurrences in New England, this species has been observed only in a swamp in eastern Lycoming County, Pa.; in all cases the soil is mediacid.

Vaccinium macrocarpon Alton.

Habitat.—Wet sphagnum peat.

This species has been observed in swamps in many places in New Jersey and Pennsylvania, the soil acidity being mediacid, or rarely subacid.

Pyxidanthera barbulata Michaux.

Habitat.—Dry and occasionally moist upland peat.

This species has been observed at many places in the New Jersey Pine Barrens, in mediacid and rarely subacid upland peat and white sand, the acidity of the latter being due to the development of auto-genous humus beneath the mats of the plant.

Galax aphylla L.

Habitat.—Dry upland peat.

This plant has been observed in the mountains of southwestern Virginia, growing in open woods, with *Epigaea* and various *Vaccinium*, in mediacid or less commonly subacid soils.

Corema conradii Torrey.

Habitat.—Dry upland peat.

Included here in view of the opinion of some botanists that this family probably represents a degenerate member of the Ericales. This species has been observed only in the Plains, east of Chatsworth, in the heart of the New Jersey Pine-barrens. It grows in white sand, mingled with autogenous humus, the reaction being mediacid.

By tabulating the data, the relative acidity requirements of the various species may be made clearly evident. Bold face X's mark optimum values, ordinary-face capitals frequently observed values, small x's occasional ones, o's observations in other regions, and n's tests in nurseries.

TABLE 2.
Acidity Relations of *Ericaceae* Studies

	Medi- acid 300	Sub- acid 100 30	Minim- acid 10 3	Neutral 1
CLETHREAE.				
<i>Clethra alnifolia</i>	X	x x	n .	.
PYROLEAE				
<i>Pyrola americana</i>	x	x X	X x	.
<i>elliptica</i>.....	.	o X	X o	.
<i>secunda</i>.....	.	x X	x o	.
<i>Chimaphila maculata</i>	x	x X	X x	.
<i>umbellata</i>	x	x X	X .	.
MONOTROPOIDEAE				
<i>Monotropa uniflora</i>.....	.	x X	x .	.
<i>Hypopitys lanuginosa</i>.....	.	. X	. .	.
<i>americana</i>.....	.	. X	. .	.
ERICOIDEAE (ERICACEAE)				
<i>Azalea nudiflora</i>	x	x X	X x	.
<i>canescens</i>	x	x X	. .	.
<i>arborescens</i>.....	.	. X	. .	.
<i>viscosa</i>	X	x x	n .	.
<i>Rhododendron maximum</i>	X	X X	x x	x
<i>Menziesia pilosa</i>	x	x X	. .	.
<i>Dendrium buxifolium</i>	X	x .	. .	.
<i>Kalmia latifolia</i>	X	X X	X .	.
<i>angustifolia</i>	X	X X	n .	.
<i>Eubotrys racemosa</i>	X	X X	x .	.
<i>Neopieris mariana</i>	X	x x	. .	.
<i>Xolisma ligustrina</i>	X	X X	x .	.
<i>Chamaedaphne calyculata</i>	X	x X	o .	.
<i>Oxydendrum arboreum</i>	x	x X	. .	.
<i>Epigaea repens</i>	X	X X	X .	.
<i>Gaultheria procumbens</i>	X	X X	o .	.
<i>Arctostaphylos uva-ursi</i>	X	X X	. .	o
VACCINIOIDEAE (VACCINIACEAE)				
<i>Chiogenes hispidula</i>	X	x x	. .	.
<i>Gaylussacia brachycera</i>	X	x x	. .	.
<i>dumosa</i>	X	. .	. .	.
<i>frondosa</i>	X	x x	. .	.
<i>baccata</i>	x	X X	X x	x
<i>Vaccinium stamineum</i>.....	.	x X	X x	.
<i>pennsylvanicum</i>	X	X X	x .	.
<i>vacillans</i>	X	X X	X x	x
<i>corymbosum</i>	X	X X	X x	.
<i>atrococcum</i>	x	X X	X x	.
<i>erythrocarpum</i>	X	X X	. .	.
<i>Oxycoccoes</i>	X	. .	. .	.
<i>macrocarpon</i>	X	x x	. .	.
DIAPENSIACEAE				
<i>Pyxidanthra barbulata</i>	X	x x	. .	.
<i>Galax aphylla</i>	X	x x	. .	.
EMPETRACEAE				
<i>Corema conradii</i>	X	x .	. .	.

In table 3 the Orchidaceae found in the Middle States are tabulated in a similar way. The article on this family previously published by the writer¹⁸ included the same species, only two (marked by an asterisk) having been since observed, but the acidity data were given numerically, and no optimum reaction was indicated. In the present table, the reactions are shown graphically, the optimum point is indicated as with the Ericaceae, and several extensions of range found as the result of many tests made since the publication of the other paper are included.

TABLE 3
Reactions Relations of Orchidaceae Studied

	Specific acidity			Specific alkalinity		
	300 Medi- acid	100 Sub- acid	30 Minim- acid	10 N	3 Minim- alk.	10
<i>Cypripedium candidum</i>.....	.	.	.	X	x	x
<i>parviflorum</i>	x	X	X	X	x	x
<i>var. pubescens</i>	x	X	X	X	x	x
<i>hirsutum</i>.....	.	.	o	X	x	x
<i>acaule</i>	X	X	x	.	.	.
<i>Orchis (Galeorchis) spectabilis</i>.....	.	x	X	X	x	x
<i>Habenaria (Blephariglottis)</i>						
<i>blephariglottis</i>	X	x	.	.	.	.
<i>ciliaris</i>	X	X	X	.	.	.
<i>cristata</i>	X	x	.	.	.	.
<i>fimbriata (grandiflora)</i> ..	.	x	X	.	.	.
<i>lacera</i>	x	X	X	.	.	.
<i>peramoena</i>.....	.	x	X	.	.	.
<i>psycodes</i>	X	X	X	x	o	.
(<i>Coeloglossum</i>) <i>bracteata</i>....	.	x	X	x	.	.
(<i>Gymnadeniopsis</i>) <i>clavellata</i> . X	X	X	X	.	.	.
<i>integra</i> *.....	X	x	.	.	.	.
<i>nivea</i>	x	X	X	x	.	.
(<i>Lysias</i>) <i>orbiculata</i>.....	.	x	X	o	.	.
(<i>Peruaria</i>) <i>flava</i>	X	X	x	.	.	.
<i>Limodorum tuberosum</i>	X	x	x	.	.	.
<i>Arethusa bulbosa</i>	X	.	.	.	.	.
<i>Pogonia ophioglossoides</i>	X	x	x	.	.	.
<i>divaricata</i> *.....	X	x	.	.	.	.
(<i>Triphora</i>) <i>trianthophora</i>.....	.	.	x	X	x	.
(<i>Isotria</i>) <i>verticillata</i>	X	X	X	x	.	.
<i>Ibidium beckii</i>	X	X	X	.	.	.
<i>cernuum</i>	x	x	X	X	x	.
<i>gracile</i>	x	X	X	.	.	.
<i>plantagineum (latifolium)</i> .	.	x	X	X	.	.
<i>odoratum</i>.....	.	x	X	x	.	.
<i>praecox</i>	x	x	X	x	.	.
<i>vernale</i>	X	X	X	x	.	.

¹⁸*Journ. Wash. Acad. Sci.* 8, 590-598, 1918.

<i>Peramium pubescens</i>	x	X	X	.	.	.	.
repens.....	x	X	o	.	.	.	.
<i>Serapias helleborine</i> (viridi- flora).....	.	X	x	.	.	.	.
<i>Malaxis unifolia</i> X	X	X	x	.	.	.	.
<i>Liparis liliifolia</i>	x	X	X	X	x	.	.
loeselii..... x	x	X	X	x	o	.	.
<i>Aplectrum hyemale</i> (spica- tum).....	x	X	X	x	x	.	.
<i>Tipuharia unifolia</i> x	x	X	X	.	.	.	.
<i>Corallorrhiza maculata</i>	x	X	x	.	.	.	.
odontorrhiza.....	x	X	x	x	.	.	.
wisteriana.....	.	x	X	x	..	.	.

April 20.

The President, JOHN CADWALADER, A. M., LL. D., in the Chair.

Twenty-nine persons present.

The deaths of Thomas Bradley, December 16, 1919, and James H. Windrim, April 26, 1919, were announced.

Mr. Leon L. Gardner made a communication entitled: "A Summer's Observations on Birds as Factors in Agriculture with Special Reference to the Crow." (No abstract.)

Thomas McKean, J. Fletcher Street, W. S. Beach, Charles P. Bower, Joseph Hepburn, Frank R. Mason, Naomi Pennock, and Anna Woolman, were elected Members; and Merritt Lyndon Fernald, Hans Friedrich Gadow, Johann Paul Lotsy, Daniel Trembly MacDougal, Raymond Pearl, William Emerson Ritter, William Schaus, William Lutley Sclater, and William Berryman Scott, Correspondents.

The Publication Committee reported the reception of the following papers for publication:

"Correlation between Vegetation and Soil Acidity in Southern New Jersey," by Edgar T. Wherry.

"Notes on Freshwater Fishes of Formosa." by Masamitsu Oshima.

The following were ordered to be printed.

CORRELATION BETWEEN VEGETATION AND SOIL ACIDITY IN SOUTHERN NEW JERSEY.

BY EDGAR T. WHERRY

By southern New Jersey is meant that portion of the state lying south of the Fall-line, which extends from the Atlantic coast near Perth Amboy, southwestward to the Delaware river at Trenton. The geology of this region has been described in many reports issued by the State Geological Survey, and in U. S. Geological Survey folios. The soils have been discussed from an agricultural standpoint in a recent publication of the U. S. Bureau of Soils.¹ Several botanists have studied the vegetation in detail, but have reached widely different conclusions as to its proper geographical classification. The various divisions which have been recognized by these workers, together with data on the geological and chemical relationships, are contrasted in table 1. These divisions have been termed zones, regions, strips, etc., but it seems desirable to have a single term to apply uniformly, and *area* most accurately expresses the desired conception. Six vegetation-areas appear to be sufficiently distinct to justify separate treatment, although there are admittedly in most places no sharp boundaries between them. In the course of vacation outings during the past several years the writer has visited typical localities in all of these areas, and has obtained data as to the relations between the vegetation and a factor not specially considered by previous workers, namely the soil acidity. This has been determined in the field by the indicator method.² The results obtained in the Coastal area have already been described,³ and in the present paper observations on the other areas are recorded.

¹Bonsteel, J. A. Soils of southern New Jersey and their uses. *U. S. Dept. Agr. Bull.* 677, (1918).

²*Journ. Wash. Acad. Sci.* 10: 217-223. 1920.

³*Ecology*, 1: 1920.

TABLE I. VEGETATION—AREAS OF SOUTHERN NEW JERSEY.

Reference	Northwest	Southwest	South	Central	East	Sea-shore
	Tension zone					
Hollick, 1899, 3.				Coniferous zone		
Stone, 1907, 453-454	Delaware Valley -- West Jersey region		Southern portion of the Cape May peninsula	Pine-barrens	Atlantic Coast strip	Maritime meadows and sea beach
Stone, 1911, 57.	Middle District		Cape May District	Pine-barrens	Coastal strip	Maritime District
Harshberger, 1911, 409, 423.	Transition area			Coniferous area		Salt strand, beach and dune
Harshberger, 1916, 16.	Middle District		Farms reverting to forest	Pine-barrens	Farms reverting to forest	Maritime District
Taylor, 1912, 229; 1915, 9.		(Not pine-barrens)		Pine-barrens	(Not pine-barrens)	
Harper, 1918, 117-124.	Greensand marl or clay belt	Cohansey region	Mainland of the Cape May peninsula	Pine-barrens	Coast strip	Beaches, moving dunes, lagoons and marshes
This paper	Marl area	Cohansey area	Cape May area	Pine-barren area	Coastal area	Maritime area
Dominant geological formations	Cretaceous Pensauken Cape May	Cape May Pensauken Miocene	Cape May	Miocene	Cape May Recent	Cape May Recent
Salts of calcium, etc.	High	Medium	Medium	Low	High	Extreme
Dominant soil reaction	Circumneutral	Subacid	Subacid	Mediacid	Mediacid	Subalkaline

ACIDITIES OF THE SOILS OF THE DIFFERENT GEOLOGICAL FORMATIONS.

For the purposes of the present study the geological formations may be grouped into: Cretaceous, Miocene, Pensauken, Cape May, and Recent. The Cretaceous strata, which outcrop toward the western side of the region, are made up of sand, clay, marl, glauconite, and fossil shells. Salts of calcium, potassium, etc., are relatively large in amount in the water extracts of the soils; and there is enough calcium carbonate present in most of the beds to neutralize any acids which develop in the soils, so that circumneutral reaction is the rule.

The Miocene consists of gravel and sand beds, which were raised above sea level soon after their deposition, and have remained so practically ever since. As a result of long-continued weathering most of the calcium and potassium salts, as well as any calcium carbonate the beds may originally have contained, have been leached out. Acids arising from the decomposition of humus or from any other source remain un-neutralized, and mediacid reaction is present nearly throughout the areas underlain by Miocene formations. In the deeper parts of the soil, however, the acidity diminishes, being as low as minimacid at depths of a few decimeters; and the banks of streams, road cuts, etc., occasionally expose low acid material.

The sand and gravel classed as the Pensauken formation, with which the Bridgeton is here included, is believed to have been derived by erosion of the Miocene, and the soils of the two are practically identical in the respects under consideration.

The Cape May formation consists of sand and clay of late Quaternary age, deposited by streams swollen by water from the great ice sheet, which reached nearly to the northern edge of the present

Hollick, Arthur. The relation between forestry and geology in New Jersey. *Am. Nat.*, 33, 1-14. 1899. Also in *Ann. Rept. State Geologist of New Jersey for 1899*: 177-201. 1900.

Stone, Witmer. The life areas of southern New Jersey. *Proc. Acad. Nat. Sci. Phila.*, 1907: 452-459.

— The plants of southern New Jersey, with especial reference to the flora of the pine barrens and the geographic distribution of the species. *Ann. Rept. N. J. State Mus. for 1910*: 21-828. 1911.

Harshberger, John W. Phytogeographic survey of North America, 790 pp. Leipzig, 1911.

— The vegetation of the New Jersey pine-barrens. An ecologic investigation. 329 pp. Philadelphia, 1916.

Taylor, Norman. On the origin and present distribution of the pine-barrens of New Jersey. *Torrey*, 12: 229-242. 1912.

— Flora of the vicinity of New York. A contribution to plant geography. *Mem. N. Y. Bot. Garden*, 5: 1-683. 1915.

Harper, Roland M. A sketch of the forest geography of New Jersey. *Bull. Geogr. Soc. Phila.*, 16: 107-125, 1918.

region. Because of containing considerable rock-flour, and of not having been long (geologically speaking) subjected to weathering, this formation yields soils relatively high in calcium and potassium salts. The content of calcium carbonate is less, however, than in the Cretaceous, so that acids are not as completely neutralized, and subacid reactions are most characteristic of the areas underlain by the Cape May.

The soil acidities of the several vegetation-areas are determined by the distribution of these different geological formations in them. In the Marl area— named after the most characteristic material represented—the salt content averages high and acidity low because the Cretaceous strata outcrop in many places. More or less isolated patches of Cape May and of Pensauken deposits occur in the area, and show locally lower salt content and greater acidity. In the Cohansey area Cape May deposits are most widespread, so that the average acidity is moderate; but again isolated patches occur, in this case occupied by Miocene and Pensauken deposits, in which the acidity is high. The Cape May and Pine-barren areas are occupied essentially by single geological formations, and show the acidities characteristic of these in each case. The peculiar features of the Coastal and Maritime areas have been discussed in the paper above referred to.

RELATION OF SOIL ACIDITY TO PLANT DISTRIBUTION.

Tests have been made of the soils surrounding the roots of a number of plants in each of these areas, and as the results obtained have furnished evidence in support of the view that plant distribution is intimately connected with soil acidity, a few typical instances may well be described here.

The rattlesnake fern, *Botrychium virginianum*, which in other regions is most frequently found in circumneutral soils, is common in southern New Jersey in the Marl area, and occasional in the Cohansey and Cape May areas; it appears to be quite absent, however, from the Pine-barren and Coastal areas. As there is no physical barrier to its spreading into the latter areas, the inference seems justified that when its spores reach these areas their germination is prevented by the high degree of acidity present. By way of contrast, the curly-grass fern, *Schizaea pusilla*, is limited to the Pine-barren and Coastal areas, and actual tests of its soils have shown mediacid reaction. Here there seems to exist an inability of the plant to become established except where the acidity is high.

The ebony spleenwort, *Asplenium platyneuron*, which is usually found in soils of but moderate acidity, grows in all the vegetation areas of southern New Jersey. In the Pine-barren and Coastal ones, however, it is found only on steep banks, where the acidity may be rather lower than in level places. The oak fern, *Phegopteris* (*Dryopteris*) *dryopteris*, a plant characteristic of cool shaded places where the soils are circumneutral, would hardly be expected to become established in the warm climate of southern New Jersey. But that its spores actually reach this region is shown by the occurrence of a colony in an old well in the Pine-barren area, where the combination of low acidity and cool atmosphere is of course attained.

In the paper above cited, as well as in studies in other regions, Dr. R. M. Harper has used the percentage of evergreen—chiefly coniferous—trees as an index of the relative poorness in salts of the soils of individual vegetation-areas. While a relation of this sort undoubtedly exists, it would be a mistake to infer from it that all conifers are alike in their soil requirements. The pitch pine, *Pinus rigida*, thrives in the salt-poor mediacid soils of the Pine-barren area; but the scrub pine, *P. virginiana*, is very rare in that area, apparently requiring subacid soil reaction and moderate salt content such as are present in the Marl area. The yellow pine, *P. echinata*, which is intermediate in its characters between the two others, appears to be relatively indifferent as to soil conditions, and grows about equally well in the Pine-barrens and the Marl area.

The Canada lily, *Lilium canadense*, elsewhere a circumneutral soil species, grows in southern New Jersey, as would be expected, only in the Marl area. The related turk's-cap lily, *L. superbum*, which seems to be partial to highly acid soils, is on the other hand widespread in southern New Jersey, and most abundant in the Pine-barren area. In the bog near Lindenwold, famous for its remarkable flora, both of these lilies grow, which might be taken as evidence that they are not particularly different in their soil acidity requirements after all. But actual observation shows that the first species grows chiefly at the lower levels in the bog, where Cretaceous strata outcrop and the soils are circumneutral, while the second occurs higher, in the highly acid soils derived from the Pensauken sand.

Among orchids many species are partial to highly acid soils, and are in southern New Jersey most abundant in the Pine-barren area. In the genus *Habenaria*, subgenus *Blephariglottis*, the three species

with fringed but simple lips, namely the white, large yellow, and small yellow fringed orchids, *H. blephariglottis*, *H. ciliaris*, and *H. cristata*, respectively, are extremely abundant in the bogs of that area. On the other hand the species with three-parted lips, the green, large purple, small purple, and short-fringed purple fringed orchids, *H. lacera*, *H. grandiflora*, *H. psycodes*, and *H. peramoena*, are limited to the areas surrounding the Pine-barrens, where they find soils of lower acidity.

The majority of the buttercup family, *Ranunculaceae*, appear in other regions to be partial to circumneutral soils, and it is a striking fact that members of this family are almost unknown in the Pine-barren area. The marsh marigold, *Caltha palustris*, has been observed in the Lindenwold bog, but it grows only at the lower levels, where the soil is circumneutral. The columbine, *Aquilegia canadensis*, can withstand a mediacid reaction if the salt content of the soils is high enough, as in the Coastal area.

The Heath family, *Ericaceae*, together with certain closely related ones, are treated in detail elsewhere; but it may be noted here how strikingly their distribution is controlled by the soil acidity. The *Pyrolas* favor subacid soils, and are very rare in the Pine-barrens though common in the Marl area. The same is true of the pink azalea, *Azalea nudiflora*, the deerberry, *Polycodium stamineum*, and the narrow-leaved low-bush blueberry, *Vaccinium pennsylvanicum* (*angustifolium*). Numerous other members of the family are, however, more abundant in the Pine-barrens than in any other area, evidently because of their preference for soils low in salts and high in acidity. When these ericaceous species grow in the Marl area, they avoid the places where calcareous marly strata actually outcrop, and grow instead upon patches of acid Pensauken sand.

BEARING OF SOIL REACTION ON THE ORIGIN OF THE PINE BARREN FLORA

In papers cited in connection with table 1, Harshberger and Taylor have independently elaborated a theory of origin of the flora of the New Jersey Pine-barrens, based on the alleged remaining above sea-level of the Miocene strata ever since their first emergence at the close of the Miocene period. According to this theory, the area occupied by these strata has been an island up to comparatively recent geological time, and the plants now growing there represent direct descendants of those of the Miocene period. This theory has been criticized from the botanical standpoint by Fernald, Harper, and others, and recent advances in geological knowledge are

decidedly unfavorable to it. Barrell¹ has pointed out that certain peneplains of the eastern United States of Pliocene and Pleistocene age have resulted from marine transgression, and it seems extremely improbable that any part of southern New Jersey could have escaped submergence during these epochs.

A consideration of the soil acidity relations indicates, however, that there is an adequate explanation of the presence of this flora, entirely aside from the geological history of the New Jersey Pine-barren area. The peculiar and isolated character of the flora of this area has been greatly overestimated, because of incomplete knowledge of the floras of surrounding regions. McAtee² has recently shown that over 70 per cent of the most typical plants of the New Jersey Pine-barrens grow in favorable places in eastern Maryland; and Harper³ has noted the presence of pine-barren plants in a strip of land crossing the Delaware peninsula. Not more than five or six of the members of the Pine-barren flora are actually endemic, the great majority of them ranging, as shown by Stone, for considerable distances northward or southward (or in both directions) from New Jersey. Nevertheless the plant association of the Pine-barren area is sufficiently striking to warrant a discussion of its origin.

The flora of the New Jersey Pine-barrens includes many plants which have migrated northward from the Coastal Plain of the southern states, such as the grass-pink orchid, *Limodorum tuberosum*; others from the southern Appalachian mountains, such as the rhododendron, *Rhododendron maximum*; and still others from arctic bogs, such as the buckbean, *Menyanthes trifoliata*. The one thing which all of these plants have in common is their adaptation to growth in soils of low salt content (as pointed out by Harper, *loc. cit.*) and *high acidity*. In the opinion of the present writer, an adequate explanation of their association to make up the flora of the New Jersey Pine-barrens is the fact that this area possesses these two characteristics to such a marked degree.

¹Post Jurassic history, etc. (Abstract). *Bull. Geol. Soc. Am.*, 24: 691. 1913. The Piedmont terraces of the northern Appalachians. *Amer. Journ. Sci.*, 49: 227-258, 327-362, 407-428, (1920).

²A sketch of the natural history of the District of Columbia. *Bull. Biol. Soc. Wash.*, 1: 86. 1918.

³A forest reconnaissance of the Delaware peninsula. *Journ. Forestry*, 17: 551. 1919.

NOTES ON FRESHWATER FISHES OF FORMOSA, WITH DESCRIPTIONS
OF NEW GENERA AND SPECIES.

BY MASAMITSU OSHIMA.

Since the publication of my paper entitled "Contributions to the Study of the Fresh Water Fishes of the Island of Formosa" (*Ann. Carn. Mus.*, 1919, pp. 169-328), many new fresh water fishes have been obtained from Formosa. Moreover, as a result of extended collections made by myself during the year 1918-1919, several species formerly considered very rare have been secured in abundance from the type-localities, or from other places on the island.

In the present paper the following eight species which seem to be new to science are fully described, and the record of new localities for the known species is given as well.

1. *Acrossocheilus invirgatus*.
2. *Lissochilichthys matsudai* (gen. et. sp. nov.).
3. *Scaphiodontella alticorpus* (gen. et sp. nov.).
4. *Leucisculus fuscus* (gen. et sp. nov.).
5. *Spinibarbus elongatus*.
6. *Rasbora tanakii* (gen. et sp. nov.).
7. *Rasbora formosa*.
8. *Cultrichthys akoensis*.

Here I express my sincere thanks to Dr. David Starr Jordan for his kind assistance in determining new species; and to Mr. Eiji Matsuda, of the Ako Public school, Formosa, who very kindly forwarded to me a fine collection of fresh water fishes from Ako.

The numbers in parenthesis, following the localities, refer to the number of specimens examined.

1. *Salmo formosanus* Jordan & Oshima.

Head 3.51 in length to base of caudal; depth 4, 66; D. 3, 11; A. 3, 10; P. 13; V. 9; snout 3.77 in head; eye 4.66; interorbital space 4; maxillary 1.84; pectoral 1.50; ventral 1.75; scales about 140 in an oblique series; branchiostegals 12; gill-rakers on first arch 7 + 10.

Jaws subequal. Origin of the dorsal nearer to the tip of snout than base of caudal, its longest ray 1.23 in head; caudal peduncle 3 in head.

Color in formalin bluish gray above, paler below; lower parts of the sides silvery; small black round spots scattered on the back and below the lateral line; sides with eight dark oval spots; base of the dorsal dusky; caudal fin fuscous; the rest of the fins whitish; head uniformly dark, paler below. Total length 148 mm.

The present specimen Taiko River at Saramao, Nanto differs slightly from the type, being a young individual. I have also fortunately obtained three grown specimens from the type-locality.

2. *Plecoglossus altivelis* Temminck & Schlegel.

Three full-grown specimens from Nankan River at Hokuzanko, Nanto. It is reported that in Sansan River and Takkiri River, Kwarenko several specimens were secured early in the spring, 1919.

3. *Parasilurus asotus* (Linnaeus).

Two from Ako.

4. *Pseudobagrus brevianalis* Regan.

Suisha River at Fumpo, Nanto (1); Nankan River at Ogyuran, Nanto (2); Ako (2).

5. *Pseudobagrus taiwanensis* Oshima.

Shishito, Nanto (2); Tozen River, Shinchiku (1); Suisha River at Fumpo, Nanto (1); Daito River, Nanto (2); Nankan River at Ogyuran, Nanto (3).

6. *Liobagrus nantoensis* Oshima.

One specimen from Ogyuran, Nanto.

7. *Liobagrus formosanus* Regan.

Head 4.19 in length; depth 5.66; D. 1, 5; A. 15; P. 1, 7; V. 6; width of head 1, 14 in its length; snout 2, 50 in head; interorbital space 2; pectoral 1, 14; ventral 2. Body strongly compressed posteriorly; dorsal outline abruptly inclined in front of the origin of the dorsal; head large, flattened, with a median shallow groove, both sides of which slightly swollen; interorbital space depressed; snout rather short, its anterior margin obtusely rounded; mouth terminal, broad, with fleshy lips; upper jaw slightly longer than the lower, with a band of villiform teeth, similar band of the lower jaw crescent-shaped, longer than that of the upper; palatine and vomer smooth; barbels 8, four on snout, two at the angle of mouth, other two on the lower jaw; root of the barbel thick; nasal barbel as long as the mental, the rostral nearly as long as the maxillary which reaches to the base of pectoral; nostrils superior, distinctly separated, the anterior in a short tube, the posterior in contact with the root

of the rostral barbel; eyes minute, superior, imbedded in skin; gill-openings rather large; gill-membranes entirely separated. Dorsal fin small, inserted anteriorly, its spine nearly half as high as the soft rays, hidden beneath the skin; adipose dorsal low and long, connected posteriorly with the base of caudal; pectoral with a sharp spine hidden in the skin, tip of the fin scarcely reaching the end of the base of dorsal; ventral entirely behind the dorsal, reaching beyond the vent; anal beneath the adipose dorsal, much shorter than the latter; caudal fin elongate, its tip slightly rounded. Body smooth; lateral line indistinct. Color in alcohol light brown, fins somewhat paler; ventral surface whitish. Total length, 80 mm.

One specimen from Shishito, Nanto, collected by the writer on March 5, 1919.

In the former paper the present species was not described in detail, because of the absence of the specimen. Shishito, where my specimen was collected, is located near the type-locality (Lake Candidius.)

8. *Clarias fuscus* (Lacépède).

Shori, Toyen (1); Ako (2).

9. *Misgurnus anguillicaudatus* (Cantor).

Inzampo, Giran (1); Ako (2); Tamazato, Kwareenko (2).

10. *Misgurnus decemcirrosus* (Basilewsky).

One specimen from Ako and Kwareenko.

11. *Formosania gilberti* Oshima.

Suisha River at Fumpo, Nanto (7); Shishito, Nanto (3); Nankan River at Ogyuran, Nanto (2).

12. *Hemimysus formosanus* (Boulenger).

Shinchiku (2); Shishito, Nanto (30); Kananau River at Kapiyan, Ako (10).

13. *Carassius auratus* (Linnaeus).

Buroko River, Giran (2); Ritakukan, Giran (5); Raupi, Giran (1); Karewan, Kwareenko (5); Rigyochi, Kawarenko (3); Kwaren River, Kwareenko (2); Tamazato, Kwareenko (5); Shori, Toyen (2); Ruhikutsu, Nanto (2); Horisha, Nanto (3); Taichu (3); Daiko River, Taichu (3); Ako (2); Kirai, Ako (1); Rinraku, Ako (2).

14. *Cyprinus carpio* Linnaeus.

Tensonpi, Giran (1); Giran River (3); Karewan, Kwareenko (1); Rigyochi, Kwareenko (2); Lake Candidius (3).

15. *Labeo jordani* Oshima.

Nankan River at Hokuzanko, Nanto (275); Shimo-tamusui River, Ako (1); Tamusui River, Taihoku (2).

16. *Acrossocheilus formosanus* (Regan).

Nankan River at Hokuzanko, Nanto (8); Shishito, Nanto (2); Horisha, Nanto (2); Heirinbi, Giran (4).

17. *Acrossocheilus invirgatus* new species. Plate V, figure 2.

Head 4.47 in length; depth 4.19; D. 3, 8; A. 2, 5; P. 15; V. 9; width of head 1.66 in its length; interorbital space 2.73 in head; snout 2.50; eye 5; pectoral 1.11; ventral 1.20; 42 scales in the lateral line, 6 scales in an oblique series between origin of dorsal and lateral line, 5 scales between the latter and the middle of belly, 3 scales between lateral line and the root of ventral; pharyngeal teeth 5, 3, 1-1, 3, 4; gill-rakers 5 + 9. Body elongate, moderately compressed, rather low; abdomen rounded; head smooth, with many mucous cavities below and behind the orbit, upper surface slightly convex; snout rounded, more or less overhanging the upper lip, sides with traces of small tubercles; upper jaw projecting beyond the lower; mouth inferior, transverse, maxillary scarcely reaching a vertical through anterior border of nostril; upper lip fleshy; lower lips thick, separated anteriorly by an interspace which is about $\frac{1}{2}$ the width of mouth; anterior border of lower jaw naked, with a sharp, transverse, horny edge; barbels four, the rostral nearly half as long as the maxillary which reaches the middle of the orbit; eye superior and slightly anterior; nostrils close together, in front of eye above; anterior nostril in a short tube; pharyngeal teeth slender, pointed; gill-rakers short. Origin of the dorsal nearer to tip of snout than base of caudal, first ray the longest; anal behind the dorsal, rather high, inserted nearer to origin of ventral than the root of caudal, when depressed scarcely reaching the root of the caudal, anterior ray the longest; ventral inserted three scales behind the origin of dorsal, not reaching the vent; pectoral reaches two-thirds distance to ventrals; caudal peduncle compressed, its depth 2 in head; caudal fin slightly forked, tip of each lobe sharply pointed. Body covered with uniform scales; lateral line continuous, nearly straight, running along the middle of the sides. Color in alcohol dark bluish gray above, sides silvery, with no black stripes; throat and belly whitish; tip of head dark; membrane of dorsal fin dark; pectorals grayish; ventrals and anal whitish, their branched rays reddish yellow; caudal fin fuscous, partially reddish-yellow colored. Total length 160 mm.

Type No. 49,946, A. N. S. P. Buraku River at Ako, collected by Eiji Matsuda on February 2, 1919.

Differs from *Acrossocheilus formosanus* in having the body lower; no black stripes on sides; 5, 3, 1-1, 3, 4 pharyngeal teeth instead of 5, 3, 2-2, 3, 5, and the anal with two undivided rays.

LISSOCHILICHTHYS new genus.

Body elongate, compressed, head smooth, pointed anteriorly; snout obtuse, bluntly rounded, slightly prominent, sides with no tubercles, no lateral lobes. Upper jaw projecting beyond the lower. Mouth transverse, inferior, horse-shoe shaped; upper lip entire, with no inner fold. Lower lips considerably broader than the upper, scarcely in contact with each other, distinctly separated from the lower jaw; postlabial groove is restricted to the lateral parts of the lower lip, not continuous. Tip of the lower jaw naked, obtusely rounded, rather fleshy, with no horny substance. Barbels four, two rostrals and two maxillaries. Dorsal 3, 8, inserted opposite to ventrals. Anal short, with 5 branched rays. Scales moderate, about 42 in the lateral line; 1. l. running along the middle of the tail. Pharyngeal teeth 5, 3, 2-2, 3, 5; gill-rakers short. Type, *Lissochilichthys matsudai* Oshima.

This genus is very closely related to *Lissochilus* Weber and Beaufort, differing from it in having smaller scales, thick lower lips, lower jaw with no horny substance, and connected lower lips.

18. *Lissochilichthys matsudai* new species. Plate III, figure 2.

Head 4 in length; depth 4; D. 3, 8; A. 3, 5; P. 14; V. 8; width of head 2 in its length; interorbital space 3 in head; snout 3; eye 3.66; pectoral 1, 36; ventral 1.36; 42 scales in the lateral line, 6 scales in an oblique series between origin of dorsal and lateral line, 5 scales between the latter and the middle of belly, 3 scales between the lateral line and the root of the ventral; pharyngeal teeth 5, 3, 2-2, 3, 5; gill-rakers 3 + 10. Body elongate, compressed, abdomen rounded; top of head more or less fallen from the back; head smooth, pointed anteriorly, bluntly rounded in front, tip of the skin partially overlapping the upper lip, sides with no tubercles; interorbital space slightly convex; lateral lobes none; upper jaw projecting beyond the lower; mouth transverse, inferior, horse-shoe shaped, maxillary scarcely reaching a vertical through the posterior border of nostril; upper lip continuous, rather thick, entire, with no inner fold; lower lip nearly twice as broad as the upper, both connected anteriorly, postlabial parts distinctly separated from the

jaw, postlabial groove interrupted; tip of the lower jaw entirely naked, edge rounded, fleshy, with no horny substance; barbels four, the rostral nearly as long as the eye, the maxillary longer, reaching beyond the posterior border of orbit; eye slightly superior and anterior; nostrils close together, in front of the eye above, anterior nostril in a short tube; pharyngeal teeth slender, hooked; gill-rakers short. Origin of the dorsal midway between the tip of snout and base of caudal, opposite to ventrals, armed with three undivided rays, the last one the longest; pectoral as long as the ventral, reaching two-thirds the distance to the latter; ventral inserted below first branched ray of the dorsal, scarcely reaching the vent; anal nearer to origin of ventral than the root of caudal, anterior ray the longest, when depressed not reaching the caudal; caudal peduncle compressed, its depth 2 in head; caudal fin deeply forked, tip of the lobes sharply pointed. Body covered with uniform cycloid scales, ventral with a scaly flap; lateral line nearly straight, running along the middle of the tail, slightly decurved anteriorly. Color in alcohol yellowish gray above, paler below; top of head dark; sides with seven dark vertical stripes, one of which at the base of caudal; back with a series of irregular, dark spots; membrane of the dorsal fin with a series of dark stripes; pectoral and anal grayish; ventrals white; caudal uniformly dark. Total length 72 mm.

Type, No. 49,947, A. N. S. P. Kunanau River, Ako, collected by Eiji Matsuda on January 2, 1919.

Kuanau River, Ako; Tamusui River at Shinten; Shishito, Nanto; Dakusui River at Musha; Suisha River at Fumpo.

Besides the type, 9 paratypes, 2 of which from the Kimanian River, show the following: Head 3.52 to 4.40; depth 3.83 to 4.13; D. III, 8; A. III, 5; P. 14, few 15 or 16; V. 8, few 9; head width 1.66 to 2; interorbital space 2.71 to 3; eye 3.40 to 4; snout 2.62 to 3; scales 6—41 or 42—5; length 77 to 116 mm.

19. *Scapheosthes tamusiensis* Oshima.

Koshiryo, Giran (2); Taiko, Giran (6); Inzampo, Giran (1); Takkiri River, Kwarenko (16); Mokuui River at Domon, Kwarenko (3); Nankan River at Hokuzanko, Nanto (3); Dakusui River at Musha, Nanto (11); Shishito, Nanto (2); Kunanau River at Kapiyan, Ako (10).

SCAPHIODONTELLA Oshima, new genus.

Body elongate, deep, compressed. Snout short, pointed anteriorly, tip of the skin extends downwards, overlapping the upper lip.

Mouth transverse, inferior; lower jaw with no lip, edge of the mandible sharp, covered with a horny layer. No labial fold. Barbels none. Dorsal fin with not more than 9 branched rays, armed with three undivided rays, inserted opposite to ventrals. Anal rather short. Pharyngeal teeth 5, 3, 2-2, 3, 5, laterally compressed, plough-shaped. Scales large, less than 45 in a longitudinal series. Lateral line continuous, running along the middle of the tail. Type *Scaphiodontella alticorpus* Oshima..

The type is very closely related to *Scaphesthes tamusuiensis* Oshima. It differs however, in having a deeper body, no barbel, plough-shaped teeth instead of canine-like, pointed ones.

20. *Scaphiodontella alticorpus* new species. Plate IV, figure 1.

Head 4.67 in length; depth 3.27; D. 3.8; A. 3.5; P. 17; V. 9; width of head 1.36 in its length; eye 5 in head; interorbital space 2; snout 2.47; pectoral 1.08; ventral 1.08; scales 43 in the lateral line, 8 in an oblique series between origin of dorsal and lateral line, 8 between the latter and the middle of belly, 4 between the lateral line and the root of ventral; pharyngeal teeth 5, 3, 2-2, 3, 5; gill-rakers 8 + 30. Body deep, elongate, slightly compressed, deepest in front of the dorsal, abdomen rounded; head rather small and short, with mucous cavities below and behind the orbit, its upper surface strongly convex; interorbital space broad, vaulted remarkably; snout short, pointed anteriorly, tip of the skin extends downwards and overlaps the upper lip; mouth transverse, inferior, crescent-shaped, maxillary scarcely reaching the anterior border of the orbit; mandibular edge sharp, broadly rounded, covered with a horny layer; upper lip smooth, with no inner fold; lower jaw with no lip; barbels none; eye small, slightly anterior and superior; nostrils close together, in front of the eye; pharyngeal teeth in three rows, laterally compressed, each tooth with an oval grinding surface; gill-rakers slender, set close together; gill-openings moderate, extending downwards and forwards. Dorsal fin inserted nearer tip of snout than base of caudal, with three smooth undivided rays, the first minute, the third nearly four times as long as the second, first branched ray the longest; anal fin entirely behind the dorsal, inserted midway between origins of ventral and caudal, rather short, outer margin nearly straight; origin of ventral below the third branched ray of the dorsal, not reaching the vent; pectoral as long as the ventral, reaching beyond half the distance to the latter; caudal penduncle short, its depth 1.72 in head; caudal fin long, deeply forked, tip of each lobe sharply pointed. Body covered with uni-

form cycloid scales; ventral with a scaly flap; lateral line continuous, slightly decurved in front, running along the middle of the tail. Color in alcohol grayish above, belly and lower parts of sides silvery; head dark; all the fins dusky, fin membranes reddish; caudal fin uniformly dark, interspace between the middle rays reddish. Total length 220 mm.

Type No. 49,948, A. N. S. P. Buraku River, Ako, collected by Eiji Matsuda on February 2, 1919.

Also paratype, Kwaren River at Kado, Kwarengo. It shows: Head 4.53; depth 3.43; fins as in type; head width 1.60; interorbital space 2.18; snout 2.66; eye 4.50; scales 8—43—7; length 138 mm.

21. *Hemibarbus labeo* (Pallas).

Heirinbi, Giran (1); Taihoku (3).

22. *Barbodes paradoxus* (Günther).

Five from Ako.

23. *Puntius snyderi* Oshima.

One from Nankan River at Ogyuran, Nanto.

24. *Spinibarbus hollandi* Oshima.

Ako (2); Rinraku, Ako (2); Shukoran River at Suibi, Kwarengo (3); Kwaren River at Kada, Kwarengo (20).

25. *Spinibarbus elongatus* new species. Plate IV, figure 2.

Head 3.58 in length; depth 5.27; D. III, 8; A. II, 5; P. 16; V. 9; width of head 1.59 in its length; eye 6 in head; interorbital space 3.12; snout 2.67; pectoral 1.36; ventral 1.53; 28 scales in the lateral line, 4 in an oblique series between origin of dorsal and lateral line, 5 between the latter and the middle of belly, 2 between the lateral line and the root of ventral; pharyngeal teeth 5, 3, 2-2, 3, 5; gill-rakers 3 + 11. Body elongate, low, slightly compressed; head elongate, rounded, dorsal outline convex; interorbital space broad, more or less compressed, with many mucous cavities around the orbit; snout long, rounded anteriorly; eye rather small, anterior and superior; nostrils close together, in front of eye; mouth sub-inferior, maxillary scarcely reaching a vertical through anterior border of nostril; upper lip fleshy; lower lips not continuous, distinct at the angle of the mouth; upper jaw slightly longer than the lower, protractile; anterior margin of the lower jaw rounded, rather sharp; barbels four, the rostral reaching beyond the nostrils, much more slender and shorter than the maxillary which reaches far beyond the orbit; gill-openings moderate; gill-rakers on first arch

slender, apical ones on the lower limb rudimentary. Dorsal fin inserted midway between the tip of snout and the base of caudal, osseous rays smooth, the first one minute, anterior ray the longest; a recumbent spine in front of the origin of the dorsal, partially hidden beneath the scales; pectoral reaching beyond two-thirds the distance to ventral; origin of ventral two scales behind that of the dorsal; anal entirely behind the dorsal, inserted nearer to origin of ventral than base of caudal, when depressed scarcely reaching the root of caudal, anterior ray the longest; caudal peduncle elongate, its depth 2.89 in head; caudal fin deeply forked, tip of each lobe sharply pointed. Body covered with large cycloid scales; ventral fin with a scaly flap; lateral line decurved, running along the middle of the side, gradually entering the middle of the tail.

Color in alcohol dark gray above; belly and lower parts of the sides silvery; base of each scale dark, dorsal fin grayish, with a series of black streaks; pectoral uniformly dusky; ventrals, anal, and caudal fuscous, more or less reddish; top of head uniformly dark. Total length 233 mm.

Type. No. 49,949, A. N. S. P. Buraku River, Ako, collected by Eiji Matsuda on February 2, 1919.

The present species is very closely allied to *Spinibarbus hollandi*. It differs from the latter in having much more lower body, round snout and 28-29 scales in the lateral line instead of 26-27.

26. *Gnathopogon iiijimae* Oshima.

Eight from Rihikutsu, Nanto.

27. *Pseudorasbora Parva* (Schlegel).

Lake Candidius (1); Rihikutsu, Nanto (abundant); Kirai, Ako (3); Shinkaiyen, Daito (11); Shukoran River at Suibi, Kwarenko (1); Kwaren River at Kada, Kwarenko (3).

28. *Phoxiscus kikuchii* Oshima.

Raupi, Giran (2); Karewan, Kwarenko (7); Kwarenko (20); Kwaren River at Kada, Kwarenko (15); Rigyochi, Kwarenko (17); Riran, Daito (6); Shinkaiyen, Daito (abundant).

LEUCISCULUS new genus.

Body robust, more or less compressed posteriorly. Head rather short, triangular; snout pointed. Mouth transverse, oblique; upper lip entire, thin; lower lips widely separated in front, postlabial folds discontinuous; anterior edge of the lower jaw naked, trenchant. Barbels none. Pharyngeal teeth in a single series, 5-4; teeth molar-like, with smooth, oval grinding surface. Dorsal fin short,

with no osseous ray or spine; anal short, with 8 branched rays, entirely behind the dorsal; root of the ventral covered by tiled scaly sheath. Scales large, imbricated. Lateral line continuous, slightly decurved, running along the middle of the tail. Type *Leucisculus fuscus* Oshima.

Very closely related to *Leuciscus*, differing from it in having single-rowed, molar-like teeth.

29. *Leucisculus fuscus* new species. Plate V. figure 1.

Head 3.46 in length; depth 3.40; D. 3.7; A. 3.8; P. 19; V. 9; width of head 1.57 in its length; interorbital space 2.43 in head; snout 3.38; eye 5.50; pectoral 1.38; ventral 1.49; 43 scales in the lateral line, 7 scales in an oblique series from origin of dorsal to lateral line, 7 scales between the latter and the middle of belly; 4 scales between lateral line and the root of ventral; pharyngeal teeth 5-4; gill-rakers minute. Body robust, elongate, more or less compressed posteriorly; deepest in front of the dorsal; dorsal outline much more curved than that of the ventral; head triangular, strongly depressed, its dorsal outline straight, inclined; interorbital space broad, nearly flat; postoperculum radially striped; snout short, sharply pointed anteriorly; mouth terminal, oblique, maxillary reaching a vertical through posterior border of the anterior nostril; upper jaw slightly longer than the lower; upper lip entire, rather thin, lower lips discontinuous, postlabial folds distinctly separated in front; tip of the lower jaw naked, trenchant; barbels none; eye large, anterior; nostrils large, close together, on the upper surface of the snout, anterior nostril in a short tube, the posterior covered by a large flap; pharyngeal teeth in a single series, molar-like, very large, with smooth, oval grinding surface; gill-rakers minute, rudimentary; gill-openings large; gill-membranes connected below the postoperculum. Origin of the dorsal a little nearer to the tip of snout than base of caudal, rather short, high, first branched ray the longest, when depressed reaching to the origin of anal, outer margin rounded; origin of anal midway between origin of ventral and the root of caudal, rather short, anterior branched ray the longest, when depressed scarcely reaching the root of the caudal; pectoral large, not reaching the root of ventral; ventral inserted below the second divided ray of the dorsal, scarcely reaching the vent; caudal peduncle short, slightly compressed, its depth 2.16 in head; caudal fin broad, forked, its lobes obtusely pointed. Scales large, cycloid, imbricated; pectoral and ventral with a short scaly flap; lateral

line continuous, weakly decurved, running along the middle of the tail. Color in alcohol uniformly grayish brown; lower parts whitish; all the fins dark brownish gray; head dark brown. Total length 230 mm.

Type. No. 49,950, A. N. S. P. Ako, collected by Eiji Matsuda in June, 1917.

30. *Achilognathus himantegus* Gunther.

Shori, Toyen (1); Kirai, Ako (4).

31. *Zacco platypus* (Schlegel).

Dakusui, Giran (1); Koshiryo, Giran (4); Heirinbi, Giran (11); Daito River, Nanto (1); Nankan River at Hokuzanko, Nanto (1); Ako (7).

32. *Zacco temminckii* (Schlegel).

Dakusui, Giran (5); Buroko River, Giran (14); Taiko, Giran (2); Raupi, Giran (1); Horisha, Nanto (4); Nankan River at Hokuzanko, Nanto (16); Rinraku, Ako (1); Kapiyan, Ako (7).

33. *Zacco pachycephalus* (Gunther).

Nine from Dakusui River at Musha, Nanto.

34. *Candidia barbata* (Regan).

Horisha, Nanto (1); Kirai, Ako (2).

RASBORINUS new genus.

Body elongate, compressed, rather high. Abdomen compressed, a soft median keel at the postventral part only. Head pointed. Mouth terminal, oblique, maxillary not reaching beyond the orbit. Lower jaw slightly projecting beyond the upper, with no prominent hook or knob. Lips thin; barbels none. Dorsal fin with no spine, with 7-8 branched rays, above the space between ventrals and anal. Anal entirely behind the dorsal, elongate, many rayed. Scales moderate, thin, deciduous. Lateral line broadly curved, running along the lower half of the tail. Pharyngeal teeth in three series, 5 or 4, 4, 2-2, 4, 4; gill-rakers slender. Type *Rasborinus takakii* Oshima.

Rasborinus is a nearest relative of *Rasborichthys* Bleeker. It differs from it in having lateral line running along the lower half of the tail and pharyngeal teeth of 5 or 4, 4, 2-2, 4, 4, instead of 5, 3, 1-1, 3, 5.

35. *Rasborinus takakii* new species. Plate III, figure 3.

Head 4 in length; depth 3.10; D. 3.7; A. 3.16; P. 14; V. 8; width of head 2 in its length; interorbital space 2.50 in head; snout

3.33; eye 3; pectoral 1.25; ventral 1.50; 36 scales in the lateral line, 7 scales in an oblique series between origin of dorsal and lateral line, 6 scales between the latter and the middle of belly, 4 scales between lateral line and the root of ventral; pharyngeal teeth 4, 4, 2-2, 4, 4; gill-rakers 3 + 9. Body elongate, compressed, rather high, dorsal and ventral profiles equally curved; abdomen compressed, proventral part rounded, postventral part with a well-developed, soft, median keel; head pointed; interorbital space broad, nearly straight; snout short, truncated in front; mouth terminal, oblique, maxillary not reaching the orbit; lower jaw slightly projecting beyond the upper, with no knob-like protuberance on the symphysis; lips thin; barbels none; eye large, anterior; nostrils close together, in front of eye above, the anterior in a short tube; pharyngeal teeth slender; gill-rakers short. Dorsal fin inserted above the space between ventral and anal, nearer base of caudal than tip of snout, with no spine, rather high, anterior ray the longest; pectoral elongate, reaching beyond the root of ventral; ventrals slender, not reaching the vent; anal fin elongate, entirely behind the dorsal, with a scaly sheath along the base, anterior ray, the longest; caudal peduncle short, its depth 2.29 in head; caudal fin deeply forked, tip of each lobe sharply pointed. Scales moderate, thin, deciduous; lateral line broadly decurved, running along the lower half of the tail. Color in alcohol grayish above, yellowish below, with a thin, dark stripe along the middle of the sides; all the fins whitish. Total length 63 mm.

Type, No. 49, 951, A. N. S. P. Ako, collected by Eiji Matsuda.

Named for Dr. Tomoe Takaki, former Director of the Institute of Science, Government of Formosa.

Besides the type, 2 paratypes from Ako and one from Rinraku, Ako which show: Head 3.73 to 4; depth 3 to 3.50; D. III, 7; A. III, 15 or 16; P. 14 or 15; V. 8; head width 1.71 to 2; interorbital space 2.40 to 3; snout 3.50; eye 3 to 4; scales 7-35 or 36-6; length 54 to 125 mm.

36. *Rasbora formosae* new species. Plate III, figure 1.

Body 4 in length; depth 4; D. 2.8; A. 2.14; P. 13; V. 8; width of head 2.25 in its length; interorbital space 3 in head; snout 3.33; eye 3; pectoral 1.38; ventral 1.50; 47 scales in the lateral line, 10 scales in an oblique series between origin of dorsal and lateral line, 5 scales between the latter and the middle of belly, 3 scales between lateral line and the root of ventral; pharyngeal teeth 5, 4, 2-2, 4, 4; gill-rakers 3 + 12. Body elongate, compressed, deepest in front of

the dorsal; dorsal outline weakly curved; proventral part rounded; postventral part trenchant, with a sharp, soft, median keel; head rather small, triangular; dorsal outline straight, slightly fallen from the back; interorbital space broad, slightly arched; snout short, truncated in front; mouth terminal, slightly oblique, maxillary reaching a vertical through anterior border of nostril; lower jaw more or less protruding beyond the upper; lips thin; barbels none; eye large, anterior; nostrils close together, in front of the eye above, the anterior covered with a small flap; pharyngeal teeth slender, hooked; gill-rakers rather slender, long. Dorsal fin above the space between ventrals and anal, inserted nearer base of caudal than tip of snout, with no spine, rather high, anterior ray the longest; pectoral short, reaching three-fourths the distance to ventral; ventral inserted in advance of the origin of dorsal, not reaching the vent; anal elongate, outer margin incurved, inserted below the last divided ray of the dorsal, anterior ray the longest; caudal peduncle depressed, its depth 2.50 in head; caudal fin deeply forked, tip of each lobe sharply pointed. Scales moderate, thin; lateral line broadly decurved, running along the lower half of the tail. Color in formalin greenish gray above, lower parts of sides whitish, sides with a dark, longitudinal band above the middle; a dark narrow band along the dorsal median line; a brownish round spot on occiput; all the fins whitish, caudal somewhat dusky. Total length 88 mm.

Type No. 49,952, A. N. S. P. One specimen from a small pond near Manka, Taihoku, collected by Takeo Aoki in June, 1919.

Also 2 paratypes, same data, which show: Head 3.81 to 3.93; depth 3.81 to 3.93; fins as in type; head width 2; interorbital 3 to 3.25; snout 3.66; eye 3 to 3.25; scales 10—45 to 47—5; length 75 to 79 mm.

The scale row of the present species distinctly differs from that of *Rasbora takakii*.

37. *Chanodichthys macrops* Gunther.

One from Heirinbi, Giran.

38. *Cultrichthys akoensis* new species. Plate III, figure 4.

Head 4.39 in length; depth 5; D. 11.7; A 3.12; P. 14; V. 9; width of head 2.25 in its length; interorbital space 3.27 in head; snout 3.40; eye 3.40; pectoral slightly longer than head; ventral 1.38; 45 scales in the lateral line, 9 scales in an oblique series between origin of dorsal and lateral line, 3 scales between the latter and the middle of belly; one scale between lateral line and the root of ventral;

pharyngeal teeth 5, 4, 2-2, 4, 5; gill-rakers 4 + 16. Body elongate, compressed, dorsal outline nearly straight, ventral profile strongly curved; abdomen compressed, pro- and post-ventral edge distinctly carinated; head moderate, its dorsal outline fallen from the back; interorbital space nearly straight; snout pointed anteriorly; mouth terminal, oblique, maxillary scarcely reaching a vertical through anterior border of nostril; jaws subequal, the lower more or less projecting beyond the upper; anterior edge of lower jaw rather sharp; eye large, anterior; nostrils close together, in front of the eye above, the anterior in a short tube; pharyngeal teeth slender, canine-like; gill-rakers setiform, slender and long. Dorsal fin inserted nearer tip of snout than base of caudal, armed with two smooth spines, first spine nearly half as long as the second, anterior ray the longest; pectoral elongate, scarcely reaching the root of the ventral; origin of ventral in advance of that of the dorsal, rather slender, not reaching the vent; anal fin high, elongate, entirely behind the dorsal, anterior ray the longest; caudal peduncle long, strongly compressed, its depth 2.43 in head; caudal fin strongly forked, tip of each lobe sharply pointed. Body covered with thin cycloid scales; lateral line continuous, abruptly bending downwards above the pectoral, thence extends backwards making a weak curve, running along the lower half of the tail. Color in alcohol grayish above, belly and lower parts of sides silvery; fins whitish; caudal fin gray. Total length 93 mm.

Type, No. 49,953, A. N. S. P. Ako, collection of Eiji Matsuda.

Differs distinctly from *Cultriculus kneri* in having 45 scales in the lateral line.

39. *Oryzias latipes* (Temminck & Schlegel).

Kizan Island, Giran (abundant); Lake Candidius (15); Taiko, Giran (4).

40. *Gambusia affinis* (Baird & Girard).

This American species was originally brought from Texas to Hawaii, by Mr. Alvin Seale. Collected from rice-fields at Kwareno. As a result of artificial propagations enforced by the Government for the purpose of extirpation of mosquitoes the present species is becoming very common in streams and stagnant pools of Formosa.

41. *Fluta alba* (Zulew).

Shori, Toyen (1); Ako (2).

42. *Anguilla mauritiana* Bennett.

One from Ako and 5 from Shinkaiyen, Daito.

43. *Anguilla japonica* Temminck & Schlegel.

Tozen River, Shinchiku (1); Lake Candidius (1); Shinchiku (2); Ako (1).

44. *Mugil cephalus* Linnaeus.

Kwaren River at Kada, Kwarengo (3); Inzampo, Giran (1).

45. *Mugil oour* Forskal.

Kwaren River at Kada, Kwarengo (2); Botansha, Daito (1).

46. *Liza troschell* (Bleeker).

One from Rinraku, Ako.

47. *Polyacanthus operculatus* (Linnaeus).

Maruyama, Taihoku (8); Ako (2).

48. *Kuhlia marginata* (Cuvier & Valenciennes).

Mokui River at Domon, Kwarengo (1); Kwarengo (2); Shukoran River, Kwarengo (3); Tamazato, Kwarengo (12); Beiron River, Kwarengo (3); Shinchiku (3).

49. *Ophicephalus tadianus* Jordan & Evermann.

Inzampo, Giran (1); Ako (2).

50. *Eleotris oxycephala* (Schlegel).

Inzampo, Giran (2); Kirburan, Giran (6); Beiron River, Kwarengo (5); Ako (2).

51. *Eleotris fusca* (Schneider).

Two from Surenbi, Kwarengo.

52. *Sicyopterus japonicus* (Tanaka).

Taiko, Giran (5); Heirinbi, Giran (2); Taichu (5); Kunanau River at Kapiyan, Ako (9).

53. *Rhinogobius candidus* (Regan).

Maruyama, Giran (5); Shito, Giran (1); Tensonpi, Giran (1); Wodensho, Taichu, (1); Lake Candidius (18); Koshiryo, Giran (6); Shishito, Nanto (4).

54. *Rhinogobius giurinus* (Rutter).

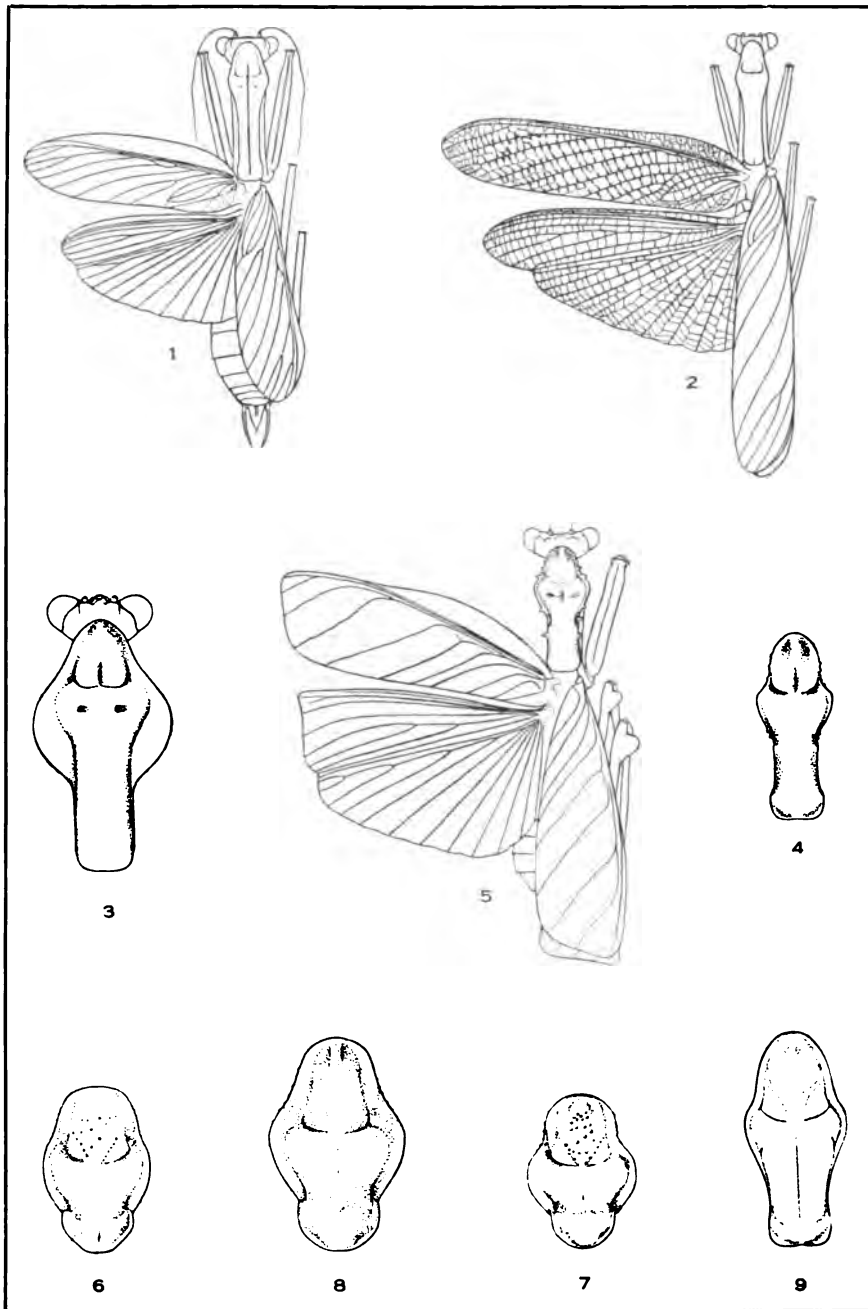
Taiha, Giran (9); Heirinbi, Giran (1); Tensompi, Giran (3); Buroko River, Giran (1); Raupi, Giran (3); Inzampo, Giran (1); Beiron River, Kwarengo (1); Sobun River, Tainan (1); Ako (1).

55. *Rhinogobius formosanus* Oshima.

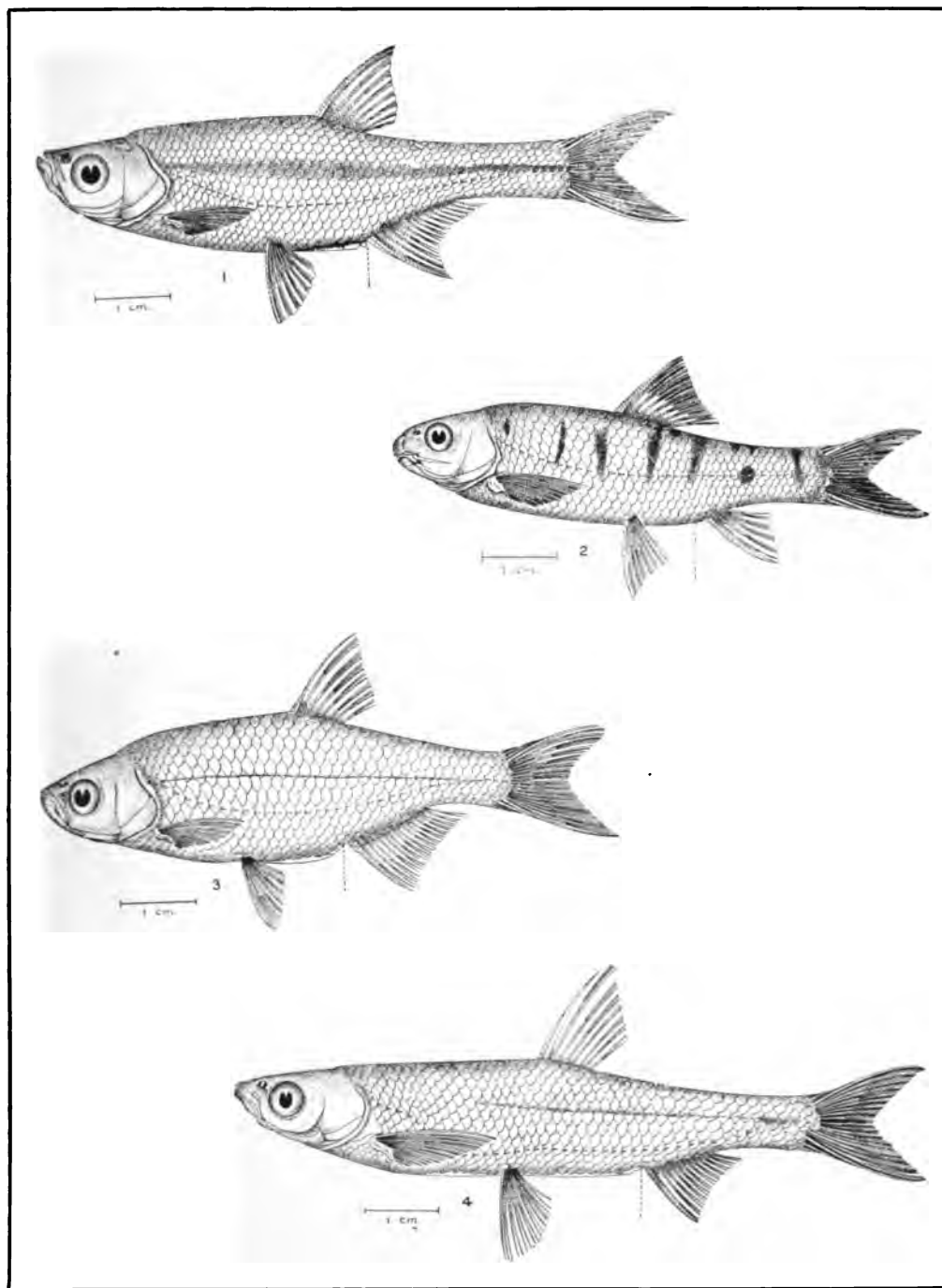
Dakusui, Giran (1); Koanronsha, Taichu (1); Ogyuran, Nanto (3); Lake Candidius (16); Sobun River, Tainan (4).

56. *Rhinogobius taiwanus* Oshima.

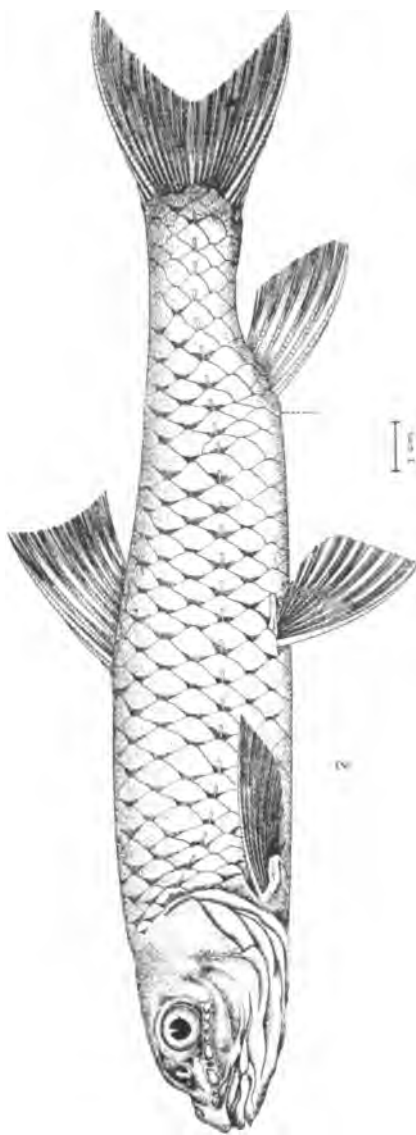
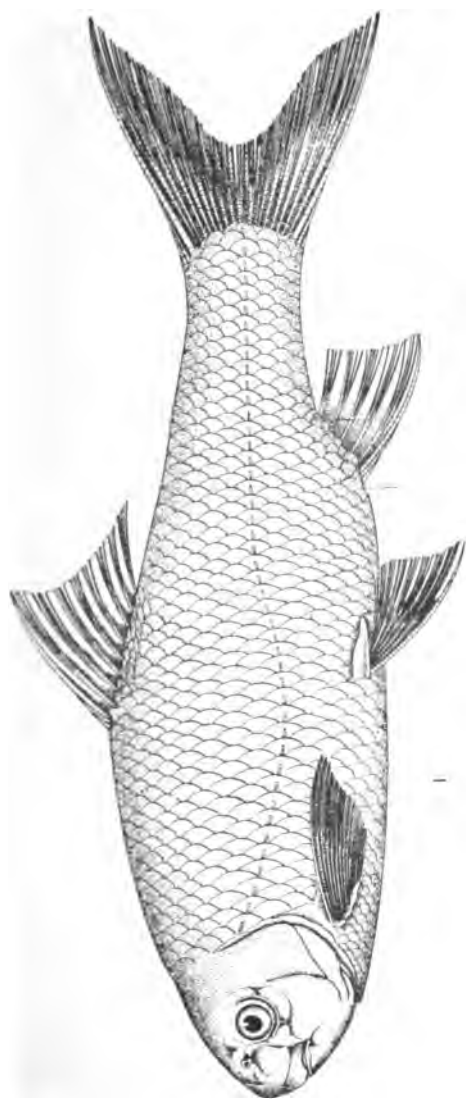
Ogyuran, Nanto (5); Heirinbi, Giran (1); Taiko River, Taichu (1).



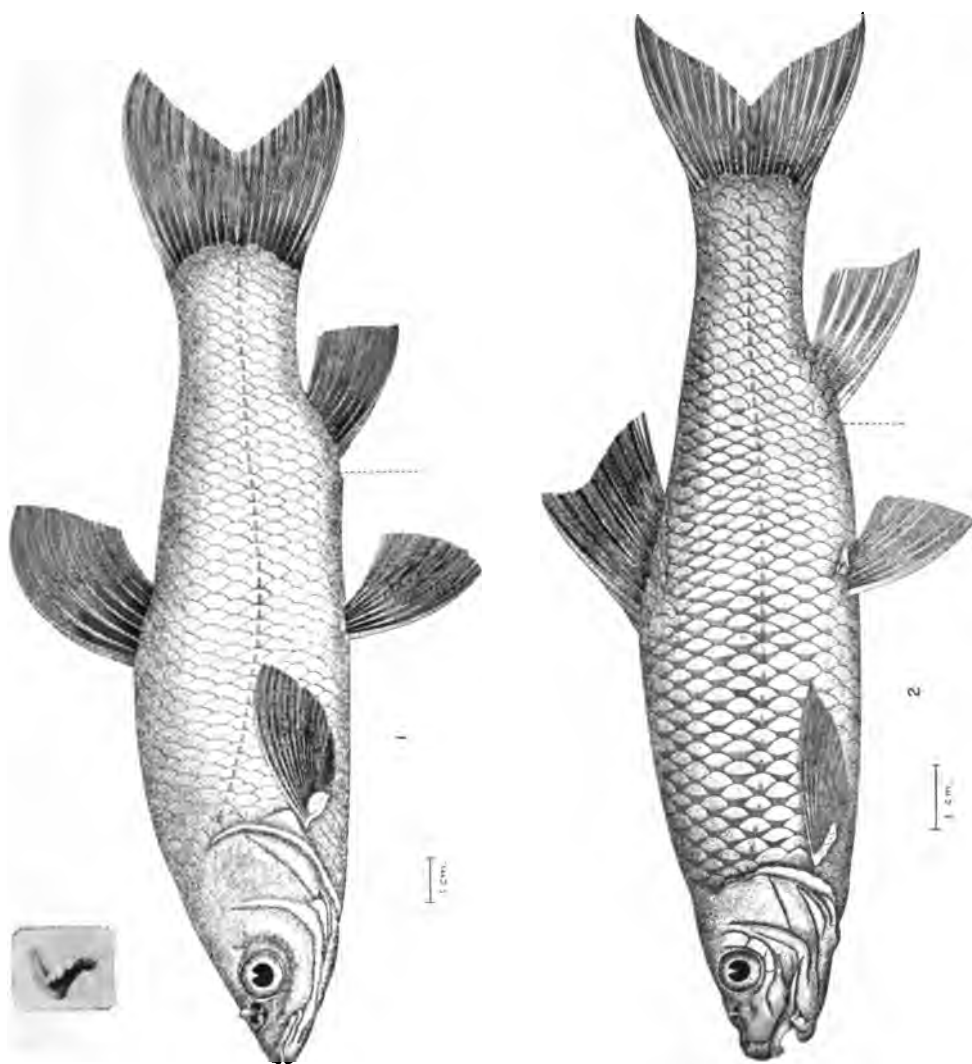
HEBARD: MALAYAN: PAPUAN, AND AUSTRALIAN MANTIDAE.



OSHIMA: FORMOSA FISHES.



OSHIMA: FORMOSA FISHES



OSHIMA: FORMOSA FISHES

57. *Glossogobius brunneus* (Schlegel).

Kwarenko (3); Maruyama, Taihoku (2).

EXPLANATION OF PLATES III, IV, V.

PLATE III.—Fig. 1.—*Rasborinus formosae* new species.

Fig. 2.—*Lissochilichthys matsudai* new genus and species.

Fig. 3.—*Rasborinus takakii* new genus and species.

Fig. 4.—*Cultricus akoensis* new species.

PLATE IV.—Fig. 1.—*Scaphiodontella alticorpus* new genus and species.

Fig. 2.—*Spinibarbus elongatus* new species.

PLATE V.—Fig. 1.—*Leucisculus fuscus* new genus and species.

Fig. 2.—*Acrossocheilus invirgatus* new species.

SCROPHULARIACEAE OF COLOMBIA—I.

BY FRANCIS W. PENNELL.

For a period of eight months, during 1917 and 1918, the writer was engaged in scientific work in Colombia. No attempt will now be made to tell the story of his adventures there, nor to give more than the briefest summary of his impressions of Tropical or Andine vegetation. A short narrative of my explorations and a comparative sketch of the plant-life seen has already been presented in the *Journal of The New York Botanical Garden* for June, 1918. I will simply say that my travels took me from the northern seacoast to the Andes east of Neiva in 3° north latitude, from the prairies and lowland forest of the Orinoco drainage, from the Magdalena and Sinu valleys, upward through every zone of vegetation to the summits of each of the three ranges of the Andes. The greatest diversity of life was seen, and the collections of plants, brought from nearly all points visited, include much that is new to science.

From July 6 to August 16, 1917, it was my privilege to work with Dr. Henry H. Rusby, of the College of Pharmacy, New York City—a companionship which to a botanical novice in a strange land was invaluable. All specimens made on and before August 16, while numbered consecutively with those made by myself alone later, are to be cited as Rusby & Pennell. . . .

Detailed maps of Colombia are difficult to obtain, and many of our collecting-stations were at small towns, or single houses. Consequently, although in the lists of specimens given I am stating the Department in which each point is located, it seems important to give a full list of the localities from which our plants have come. Arranging these in the order of our itinerary, and grouping them according to broad natural areas of topography, should enable anyone to place approximately any station. For each point the Department is stated. The names of houses are placed in quotation marks.

Northern Seacoast:

July 6, 1917. Cartagena, Bolívar.

Along Rio Magdalena:

- July 8, 1917. Barranquilla, Bolívar
- " 10, " Calamar, "
- " 11, " El Banco, Magdalena
- " 12, " Gamarra and Carpentiera, Magdalena
- " 14, " Puerto Berrio, Antioquia
- " 15, " Buenavista, Caldas.

Plain of Tolima:

- July 16, 1917. Mariquita and San Lorenzo, Tolima.

Plain of Upper Magdalena:

- July 19, 1917. Girardot, Cundinamarca
- " 21, " Espinal to Cuamo, Tolima
- " 22, " Cuamo to Rio Saldaña, Tolima
- " 22, " Rio Saldaña to Natagaima, Huila
- " 24, " Quebrada de Angeles, "
- " 25, " Quebrada de Angeles to Rio Cabrera, Huila
- " 26, " Rio Cabrera to Villavieja, "
- " 27, " Villavieja to Neiva, "
- " 30, " Neiva, Huila.

Cordillera Oriental:

- July 30 to August 8, 1917. Excursion from Neiva over the crest of the Cordillera to "Balsillas", and return.

Along Upper Magdalena:

- August 8-9, 1917. Neiva, Huila
- " 12, " Natagaima, Huila
- " 13, " Boca Saldaña, Huila.

Railroad from Girardot to Bogotá:

- August 14, 1917. Portillo, Anapoima, San Joaquin, Hospicio, La Esperanza, Cachipay, Zipacon and Anolaima, Cundinamarca.

Upper western slopes of Cordillera Oriental:

- August 16, 1917. Bogotá, Cundinamarca.

Eastern slopes of Cordillera Oriental:

- August 22, 1917. Chipaque, Cundinamarca
- " 23, " Caquezá, "
- " 24, " Caquezá to Rio Sananie, Cundinamarca
- " 24, " Quetame to "Susumuco," "
- " 25-26, 1917. "Susumuco," "

Plain of Meta:

- August 26 to September 2, 1917. Villavicencio, Meta.

Eastern slopes of Cordillera Oriental:

- September 4, 1917. Villavicencio to "Buenavista," Meta
- " 4, " "Buenavista" to "Pipirál," Cundinamarca
- " 5, " "Pipirál" to "Susumuco," "
- " 5, " "Guayabetál," "
- " 6, " "Guayabetál" to "Monte Redondo," Cundinamarca
- " 7, " "Monte Redondo" to Quetame, "
- " 7-8, " Caquezá, "
- " 8, " Ubagué, "

Summit of Cordillera Oriental:

- September 8, 1917. Paramo de Cruz Verde, Cundinamarca.

Upper western slopes of Cordillera Oriental:

- September 12, 1917. Bogotá and Mt. Guadalupe, Cundinamarca
- " 13, " Bogotá (Rio San Francisco), "
- " 15, " Tequendama, "
- " 17, " Bogotá (Monserate), "
- " 18, 23, " Bogotá (Chapinero), "

Summit of Cordillera Oriental:

- September 20, 1917. Paramo de Cruz Verde, Cundinamarca.

Upper western slopes of Cordillera Oriental:

- September 20, 26, 1917. Bogotá (Rio San Cristobal), Cundinamarca
 " 22, 24, " " (Rio del Arzobispo), "
 " 24, 25, " " (Las Cruces), "
 " 26, " " (Cerro de Focha), "
- Summit of Cordillera Oriental:
 September 27, 1917. Paramo de Choachi, Cundinamarca.
- Upper western slopes of Cordillera Oriental:
 September 30, 1917. Bogotá (San Cristobal), Cundinamarca
 October 4-8, " " "
 " 6, " " (Chapinero), "
 " 6, " Rio Teusaca, "
 " 12, " Bogotá (Rio San Cristobal) "
 " 13-15, " Sibaté to El Peñon, "
 " 20-24, " Zipaquirá to Mt. Chuscal, "
 " 23, " Nemacon, "
 " 28, " Tequendama, "
 " 29, " Sibaté to El Peñon, "
- Summit of Cordillera Oriental:
 November 14, 1917. Paramo de Cruz Verde, Cundinamarca.
- Lower western slopes of Cordillera Oriental:
 November 28-30, 1917. Fusagasugá, Cundinamarca
 December 1-4, " Pandi and Icononzo, Cundinamarca.
- Plain of Upper Magdalena:
 December 4-5, 1917. Melgar and Girardot, Cundinamarca.
- Eastern slopes of Cordillera Central:
 December 11, 1917. Libano, Tolima
 " 15-17, " "Rosalito," between Murillo and Paramo de Ruiz,
 Tolima
 " 16-17, " Paramo de Ruiz, Tolima
 " 17-18, " Murillo, "
 " 18-29, " Libano ("La Trinidad" and "La Virginia"),
 Tolima
 " 29-30, " "El Convenio," Tolima.
- Plain of Tolima:
 December 30, 1917. San Lorenzo, Tolima
 January 6, 1918. Guayabal and San Felipe, Tolima
 " 3, 7, " Honda and Mariquita, "
- Along Rio Magdalena:
 January 9-10, 1918. Brazuela de Perales, Antioquia
 " 11-13, " Puerto Berrio and Malena, Antioquia
 " 14, " Vuelta de Acuña, "
 " 14, " Opposite Boca Carare, "
 " 15, " Cafabetál, Bolívar.
 " 15, " Boca de Rosario, Puerto Nuevo and Boca Sogomosa,
 Santander
 " 16, " El Banco, Magdalena
 " 18-19, " Magangué, Bolívar.
- Plain of Bolivar:
 January 24, 1918. Buenavista, Bolívar
 " 25, " Sincé and Corozál, Bolívar
 " 26, " Sincelejo, "
 " 27, " Chinu and Sahagun, "
 " 28, " Cienaga de Oro and Cereté, Bolívar
 " 30, " Monteria.
- Along Rio Sinu:
 February 3, 1918. "Medellin," Bolívar
 " 4, " "Los Hurtados," Bolívar
 " 5, " Morales, "
 " 6, " Barro Blanco, "
 " 8, " Tierra Alta and Boca Tai, Bolívar

- " 10-11, " "Angostura" and Frasuillo, "
 " 13-14, " Boca Verde. "
 Upper slopes of Cordillera Occidental:
 February 23, 1918. Paramo de Chaquiro, Bolívar
 " 25, " Cascada Chorrón. "
 Along Rio Antizales:
 February 25-26, 1918. Antizales, Bolívar.
 Along Rio Esmeralda:
 February 26, 1918. Boca Antizales, Bolívar
 " 27, " "Las Dantas" to "Puerto Canoa," Bolívar
 " 28, " "Puerto Canoa" to "Salvajin." "
 Along Rio Sinu:
 March 1, 1918. Boca Esmeralda, Bolívar
 " 4, " Boca Verde, "
 " 5-6, " Frasuillo and "Angustura," Bolívar
 " 7-10, " Boca Tai and Tierra Alta, "
 " 11, " Morrocoquiel, "
 " 12, " "Los Hurtados," "
 " 21, " Montería, "
 " 23, " Vilches, "
 " 25, " "El Pueblo," below Lórica. "
 Northern Seacoast:
 March 26-27, 1918. Cartagena and Turbaco, Bolívar
 April 1, " Santa Marta, Magdalena.

Of chief interest has been the comparison of the vegetation of different altitudinal life-zones, and these upon the slopes of the three divergent Cordilleras of the Andes. The central axis of the Andes, entering Colombia from the South, soon divides into three ranges, all of which, rising from the midst of a broad low Tropical plain, reach high elevations. Also in the northeast is the wholly isolated Sierra Nevada de Santa Marta. Upon each mountain system, one ascends from Tropical lowland, forest or prairie ("Sabana"), through Subtropical forest, through Temperate forest or "Sabana," to the "Paramo," as the treeless chill slopes above timber-line are called. Temperature and moisture cause the floras of the different zones to differ, and similarly the isolation of the different mountain systems accounts for a divergence in the floras of the same zone on each chain.

Dr. Frank M. Chapman, in his "Distribution of Bird Life in Colombia," has given us a masterly presentation of this problem, and I adopt his system of life zones and his terminology of each. As stated in his summary on page 85 of volume 36 of the *Bulletin of The American Museum of Natural History*, these are:

- Tropical Zone—sea-level to 4,500-6,000 ft. (1350-1800 meters).
 Subtropical Zone—4,500-6,000 ft. to 9,000-9,500 ft. (2,700-2,850 meters).
 Temperate Zone—9,000-9,500 ft. to 11,000-13,000 ft. (3,300-3,900 meters).
 Paramo Zone—11,000-13,000 ft. to snow-line, 15,000 ft. (4,500 meters).

My observations have led me to occasional slight modifications of his limits, as in placing the lower limit of the Paramo above Bogotá at only 3100 meters. Here local conditions explain such a change. But in general outline, and in nearly all details, his scheme may be adopted for plants as for animals. Plants seem more subject to geographical differentiation than animals, so that in certain genera the same zone on different Cordilleras has related, but never the same, species. A fuller discussion of this subject will be given in the concluding paper of this series—now I wish but to make the summary of distribution accompanying each species of this study intelligible.

The vegetation of a land so diverse as Colombia is immensely rich; consequently upon a short expedition it has been impossible to follow out in comparative study any wide number of families. A few groups well selected, and so far as possible all their species considered, will give data for geographical botany nearly as precise as would the comparing of many families. I have studied the Scrophulariaceae, keeping a record of each species, and making a careful floral description of each. For the Temperate and Paramo zones, and for the Tropical prairies, this family furnishes an excellent index to floral areas. My collections were mainly in these regions, and of herbaceous plants, so that from a phytogeographical viewpoint, the selection of this family has been justified. It is my hope to follow this study with that of some allied group requiring forest environments, probably of the Gesneriaceae.

The present paper gives the results of a study of only about one-half the Scrophulariaceae of Colombia—those which we may call the Antirrhinoid genera. These fall into several tribes, each predominant or restricted to a special life-zone. The Gratiroleae are mainly Tropical, while wholly so are the Russelleae and Angelonieae. The Mimuleae, Hemimerideae and Fagelieae, the last with many conspicuous species, predominate in the Temperate Zone of the mountain-slopes. The genus *Bartsia*, of the Rhinanthoid Scrophulariaceae and so yet to be studied, is best developed in the Paramo Zone.

Necessarily the chief basis of this study has been my own collections. I have however revised all the collections from Colombia which I know to be in the United States. These are surprisingly meagre, and from widely scattered localities. The chief are those made by H. H. Smith in the Sierra Nevada de Santa Marta in 1899-1901; by I. F. Holton near Bogotá and in Vallé in 1852-1856;

and—more imperfect—certain series of specimens made in southern Colombia by F. C. Lehmann and at widespread stations over the country by José Triana. To the custodians of the herbaria which have loaned me specimens, the United States National Museum, Gray Herbarium, and Field Museum of Natural History, as well as to my colleagues at The New York Botanical Garden, I am under obligation.

Also, I would mention my indebtedness to that group of Colombian workers whom I had the privilege of meeting in 1917, the growth of whose museum at Bogotá has been phenomenal. Especially would I thank Brothers Aristé-Joseph and Ydinael, Hermanos Cristianos of the Universidad de La Salle. A further word of appreciation must be given to Sr. Santiago Cortés of Bogotá, who, working long alone, has been able to give to the world only the first volume of his "Flora de Colombia."

The following study is primarily systematic, and keys are given throughout. New species and those seen by the writer are carefully described. Synonymy for Colombia is cited fully, otherwise only those names are included which are of first descriptions of Colombian species. The original statement of distribution, or of type-specimen is quoted, and the effort is made to firmly establish the nomenclature used. But it must be said that, as most of the types are in Europe and inaccessible to me, and as Colombia's flora is as yet very partially known, we cannot be certain of the identity of some of these. But I believe that, with very few exceptions, the names now used will be permanent.

For each species a statement of environment and distribution is given, the latter made as definite as our knowledge permits, and analysed accordingly to life-zone and Cordillera. Lastly is given a list of specimens seen, these grouped under the Departments which at present (1920) are in force. State-outlines in Colombia have been so shifting that these limits have not always been easily ascertainable. The herbaria in which specimens may be consulted are indicated by the symbols:

A—The Academy of Natural Sciences of Philadelphia.

C—Field Museum of Natural History, Chicago, Ill.

H—Gray Herbarium of Harvard University, Cambridge, Mass.

U—United States National Museum, Washington, D. C.

Y—New York Botanical Garden, Bronx Park, New York City.

My own collections may all be consulted at The New York Botanical Garden. Duplicates are being distributed to many herbaria.

At the conclusion of the systematic portion of this study there is planned a synopsis of the geographic distribution of the Scrophulariaceae of Colombia, and also a series of brief sketches of those collectors in Colombia to whom reference will have been made in the text.

KEY TO ANTIRRHINOID SCROPHULARIACEAE OF COLOMBIA.¹

Corolla with the posterior lobes external in the bud.

(ANTIRRHINOIDEAE.)

Capsule septicidal, or loculicidal by a simple median split, the septum breaking from the capsule-wall or rupturing. Corolla not spurred. Leaves opposite or whorled in threes (except in *Capraria*).

Corolla, even if saccate anteriorly, without a horn-like process at the base of the anterior lobes. Capsule septicidal, or loculicidal. Seeds, if reticulate, with lines not raised or wing-like.

Stigma two-lipped.

Capsule septicidal, or secondarily also somewhat loculicidal, splitting to base; placentae simple. Sepals distinct or nearly so (except in *Vandellia* and *Torenia*). Leaves, or rarely only the capsule, somewhat glandular-punctate. Inflorescence simply racemose (if several pedicels are in one axil, then no common peduncle is evident). Corolla yellow, blue or white.

I. GRATIOLEAE.

Capsule loculicidal (only tardily septicidal if at all), or indehiscent; placentae branched and widely spreading. Sepals united over one-half length. Leaves and capsule not glandular-punctate. Inflorescence racemose, or of axillary cymes a single one of which is terminal to the primary peduncle. Corolla yellow, two-ridged and pubescent within on the anterior side.

II. MIMULEAE.

Stigma capitate.

Corolla conspicuously zygomorphic, the tube scarcely developed and the anterior lobes much exceeding the posterior ones. Capsule without placental hairs, and dehiscing only distally. Seeds ridged, not reticulate. Leaves opposite, or the upper alternate.

Stamens four; anther-sacs with membranous walls. Corolla orange, flattened, its lobes all evident, the tube split to base between the posterior lobes. Sepals five, less than one-half the length of the capsule.

¹The warning must be given that the keys to tribes and genera are prepared for Colombian species, and contrasts may not hold for extra-limital genera and species.

Capsule scarcely dehiscent loculicidally. Seeds blackish. Inflorescence simply racemose. Stem quadrangular.

III. HEMIMERIDAEAE.

Stamens two; anther-sacs with firm walls. Corolla yellow, its lips concave-saccate or the posterior much reduced, the individual lobes scarcely or not evident, the tube not split to base between the posterior lobes. Sepals four, at least one-half the length of the capsule. Capsule dehiscent loculicidally as well as septicidally. Seeds brown. Inflorescence cymose, two pedicels of each cyme being terminal to the primary peduncle. Stem terete or nearly so.

IV. FAGELIEAE.

Corolla red, nearly regular, tubular, the short lobes nearly equal. Capsule filled with slender hairs between which are the scattered seeds, dehiscent to base septicidally. Seeds reticulate, not ridged. Leaves whorled in threes, and the stem with six angles. Inflorescence of axillary cymes, two pedicels of each being terminal to the primary peduncle.

V. RUSSELIEAE.

Corolla violet-blue, saccate anteriorly and with a fine horn-like process at the base of the anterior lobes. Capsule loculicidal, the septum only tardily if at all splitting sagittally. Seeds reticulate, the reticular lines raised into wing-like processes. Inflorescence simply racemose.

VI. ANGELONIEAE.

Capsule loculicidal, the septum and adjacent capsule-wall persisting, the remaining wall splitting irregularly. Corolla blue, with a spur at the base of the anterior petal. Leaves alternate.

VII. ANTIRRHINEAE.

Corolla with the antero-lateral or anterior lobes external in the bud. (RHINANTHOIDEAE.²)

I. GRATIOLEAE.

Leaves alternate, serrate. Stamens five. Corolla essentially regular, the five lobes equally distinct. 1. *Capraria*.

Leaves opposite or whorled in threes. Stamens four, three or two (the posterior one lost). Corolla more or less zygomorphic, the two posterior lobes united over one-half their length.

Leaves entire to serrate-dentate. Capsule globose to lanceolate in outline. Seeds not regularly cylindric nor spirally ridged, disposed in more than one row within each valve of the capsule.

Corolla with the ridges to the antero-lateral sinuses, if developed, low and not projecting beyond those points (so anterior filaments simple). Style not with a semi-persistent callose base. Septum rupturing, so that the

² To be considered in a second paper.

placental mass eventually stands free. Pedicels frequently bibracteolate. Stem, if quadrangular, with the angles not conspicuously ridged or winged.

Anther-sacs proximate, no connective arms developed.

Seeds reticulate. Leaves sessile or nearly so.

Pedicels bibracteolate. Sepals five.

Pedicels bibracteolate at base (remote from the calyx). Corolla yellow, pubescent within at base of posterior lobes. Sepals unequal, and leaves serrate. Plant repent-ascending.

2. *Mecardonia*.

Pedicels bibracteolate at apex (just beneath calyx).

Corolla violet-blue or white.

Filaments four, all with anthers. Bractlets 1 mm. or less long, much shorter than the sepals.

Sepals unequal, the outer much larger than the narrow innermost. Corolla pubescent within at base of posterior lobes, or glabrous, violet-blue or white. Capsule globose-ovoid to oblong. Leaves serrate to entire, and stems, erect or ascending.

3. *Caconapea*³

Sepals uniform. Corolla pubescent within at base of the anterior lobes. Capsule depressed-globose. Leaves serrate and stem repent-ascending.

4. *Conobea*.

Filaments two, the anterior rudimentary or wanting. Bractlets 5-10 mm. long, equaling or exceeding the nearly uniform sepals. Corolla pubescent at base of the posterior lobes, white or pinkish-tinged. Leaves serrate and stem ascending or erect.

5. *Gratiola*.

Pedicels not bracteolate. Sepals four or five. Corolla blue or white.

Corolla glabrous within. Sepals unequal, the innermost narrowest. Leaves palmately veined, entire or slightly undulate. Pedicels tending to deflex in fruit. Plants repent.

Outermost sepal cordate, much exceeding the linear-attenuate innermost ones; five sepals always present. Capsule oblong or ovoid-oblong, acute, brown, much shorter than the sepals. Styles united to apex. Corolla blue or white.

6. *Monocardia*.

³*Bramia monnieri* (L.) Pennell, a repent herb, with broadly rounded entire leaves, corolla with distinct posterior lobes, and outer sepal scarcely longer than the innermost, is widespread in Tropical America, and must surely occur on moist semi-brackish sands along the Colombian coast. See, Proc. Acad. Nat. Sci., Phila. 1919: 243, 1920.

Outermost sepal ovate-oblong, scarcely longer than the lanceolate innermost, one of which may be lost. Capsule nearly globose, obtuse, pale-brown, little shorter than the sepals. Styles distinct near apex. Corolla white.

Corolla 4 mm. long, appearing four-lobed because the three petals forming the anterior lip are all evident. Stamens four. Sepals five or four. 7. *Macuillamia*.

Corolla 2 mm. long, appearing three-lobed because the anterior petal is lost, leaving the anterior lip two-lobed. Stamens three (only one of the antero-lateral pair developed). Sepals four. 8. *Hydranthelium*.

Corolla white, densely hirsute within over bases of all lobes. Sepals four, uniform. Leaves pinnately veined, serrate-dentate. Pedicels permanently ascending-spreading. Plant erect.

9. *Scoparia*.

Anther-sacs separated on short arms of the connective. Seeds longitudinally striate, the striae frequently tuberculate. Corolla blue or white. Plants erect.

Pedicels bibracteolate, 1 mm. long or less. Corolla blue, pubescent within on the anterior side. Capsule acuminate. Seeds tuberculate-striate. Leaves cordate-clasping at base. Tall herb.

10. *Stemodia*.

Pedicels not bracteolate. Corolla pubescent within on the posterior side, or glabrous. Seeds minutely roughened-tuberculate or smooth. Leaves narrowed at base.

Leaves sessile or nearly so, in whorls of three. Corolla 9-13 mm. long, glabrous within, blue. Capsule acuminate. Seeds minutely roughened-tuberculate. Style semi-persistent. Tall herb.

11. *Unanuea*.

Leaves evidently petioled, opposite. Corolla 4-8 mm. long, pubescent within on the posterior side, blue or white. Capsule acutish. Seeds smooth, with rounded ridges. Style soon deciduous. Low herbs.

12. *Lendneria*.

Corolla violet-blue or white, with two raised ridges (each formed by the adherence of a filament) to the antero-lateral sinuses, and which frequently project as knob-like processes beyond those points (the free portion of the filament appearing as a lateral outgrowth of the adherent portion). Style with a semi-persistent, frequently enlarged and callose base. Septum persistent, with the attached placentae. Pedicels never

bracteolate. Stem quadrangular, the angles ridged or slightly winged.

Sepals united over one-third length. Filaments all with anthers. Seeds not with transverse lines. Leaves petioled, serrate-dentate. Angles of stem slightly winged.

Pedicels 1-2 mm. long. Sepals united nearly one-half their length, much shorter than the capsule. Corolla straight, the tube strongly horizontally flattened, the posterior lip purple-brown, elsewhere corolla white throughout, pubescent within on ridges to antero-lateral sinuses; the free portions of the anterior filaments appearing as up-curved from the apices of these ridges. Capsule acuminate, finely pubescent to glabrous. Seeds tuberculate. Leaves oval, rounded, narrowed at base. Plant repent, pubescent.

13. *Vandellia*.

Pedicels 10-25 mm. long. Sepals united over three-fourths length, equaling or slightly longer than the capsule. Corolla decurved, the tube scarcely or not flattened horizontally, blue or white, glabrous within on the ridges to antero-lateral sinuses; the free portions of the anterior filaments appearing as outgrowths proximad to the apices of these ridges which therefore terminate as short knobs. Capsule mucronate or acute, glabrous. Seeds shallowly pitted. Leaves ovate or lanceolate-ovate, acute, truncate-cuneate at base. Plants repent to erect, glabrous.

14. *Torenia*.

Sepals distinct or nearly so. Antero-lateral filaments without anthers. Seeds with fine transverse lines. Leaves sessile, mostly clasping, slightly crenate or entire. Angles of stem ridged, not winged. Corolla blue. Plant diffused-ascending, glabrous.

15. *Ilysanthes*.

Leaves pinnatifid. Capsule linear-attenuate in outline. Seeds regularly cylindric, spirally ridged, disposed in one row within each valve of the capsule. Corolla purple-blue. Plant low, branched, erect.

16. *Schistophragma*.

II. MIMULEAE.

Capsule oblong, dehiscing loculicidally, its walls dry, membranous, brownish. Calyx-tube longer than and enclosing the capsule, its ribs slightly winged, its lobes decidedly unequal, the posterior longest. Corolla 10-15 mm. long, yellow, with many red-brown spots within throat on the anterior side. Leaves broadly ovate, shortly petioled, 1-4 cm. long. Inflorescence of axillary simple pedicels. Stem obscurely angled, not winged. Plant low, repent-ascending.

17. *Mimulus*.

Capsule globose, indehiscent, its walls fleshy, white. Calyx-tube shorter than the capsule, its ribs not winged, its lobes slightly unequal, the posterior longest. Corolla 15–18 mm. long, yellow throughout. Leaves lanceolate, cordate-clasping at base, 15–20 cm. long. Inflorescence of axillary several-branched cymes, borne upon conspicuous peduncles. Stem with angles narrowly winged. Plant tall, erect, widely branched from base.

18. *Leucocarpus*.

III. HEMIMERIDEAE.

19. *Alonsoa*.

IV. FAGELIEAE.

20. *Fagelia*.

V. RUSSELIEAE.

21. *Russelia*.

VI. ANGELONIEAE.

22. *Angelonia*.

VII. ANTIRRHINEAE.

23. *Linaria*.

1 *CAPRARIA* Linné.

Capraria L., Sp. Pl. 628. 1753.

Type species, *Capraria biflora* L.

1. *Capraria biflora* L.

Capraria biflora L., l. c. 628. 1753. "Habitat in Curassao." Specimens from Curaçao seen in herbarium New York Botanical Garden.

Capraria lanceolata Vahl, Ecl. Am. 2: 47. 1798. "Habitat ad St. Martham. von Rohr." Not *C. lanceolata* L. f., Suppl. 284. 1781. Von Rohr's plant was the pubescent form prevalent in Colombia, but appears to have represented an abnormal state in which the pedicels are short and arise from an abbreviated branch.

Capraria semiserrata Willd., Sp. Pl. 3: 324. 1800. New name for *C. lanceolata* Vahl.

Capraria semiserrata berterii A. DC.; Benth. in DC. Prod. 10: 429. 1846. "Ad Stam. Martham (Bert. in h. DC.)." An entire-leaved state.

A widespread species of lowland Tropical America, growing mostly on and near the seashore, but extending inland on river-banks, plains and waste land. Very variable, but with most states found in the same region or even in the same colony. Varies in size of leaves, in form of leaves from linear-lanceolate to nearly ovate, and in serration from entire to sharply serrate-dentate; varies in the length of the pedicels; varies in length of and attenuation of the sepals, in size of corolla from 8 to 10 mm. long, and somewhat pubescent or glabrous within anteriorly, and in capsules from oblong to ovoid, and from round and emarginate to acutish. Most conspicuously does the plant vary in pubescence, from glabrous throughout, through states with the stem pubescent and the pedicels glabrous or the pedicels sparsely pubescent—pubescent either with short or long hairs—to forms densely hirsute on stems, pedicels, sepals and

the midribs and margins of the leaves. The last state (forma *hirta*⁴ Loes. in Bull. Herb. Boiss. ser. II, 3: 284. 1903. "Habitat in Guatemala, in dept. Chiquimula in ruderalibus ad S. Juan Ermita: Sel[er] n. 3314." Isotype seen in herbarium New York Botanical Garden) prevails in Colombia.

River-banks, flats and sandy waysides, at altitudes below 200 meters, Tropical zone; the typical form near the Caribbean shore (doubtless also along the Pacific shore), forma *hirta* Loes. (indicated in lists by asterisk) along the lower river-courses and across the Sabana of Bolívar.

Antioquia. *Brazuela de Perales, on Rio Magdalena (river-flat, alt. 150 m.), Pennell 3704; *Vuelta de Acuña, on Rio Magdalena (sandy loam, alt. 125-130 m.), Pennell 3789.

Bolívar. *Calamar (along Rio Magdalena, alt. 15-25 m.), Rusby & Pennell 20; Cartagena, I. F. Holton 582 (H, Y), (roadside, alt. 5-10 m.), Rusby & Pennell 3 (somewhat pubescent with short hairs). *Sincé (edge of thicket, alt. 120-170 m.), Pennell 4039; *Turbaco (thin loam over white rock, alt. 150-200 m.), Pennell 4761; *Vilches, on Rio Sinu (orchard, alt. 20-50 m.), Pennell 4711.

Magdalena. *Bonda (open damp place, alt. 45 m.), H. H. Smith 1331 (C, H, U, Y). Don Jaco (near the coast), H. H. Smith 551 (C, H, U, Y). Playa Brava (open plain near the coast), H. H. Smith 2823 (Y). Santa Marta (railroad bank, alt. 0-10 m.), Pennell 4771. Around Rio Frio (between the Ciénaga de Santa Marta and the foothills, alt. 0-100 m.), H. Pittier 1611 (U).

2 MECARDONIA Ruiz and Pavon.

Mecardonia R. & P. [Fl. Peruv. et Chil. Prod. 95. 1794, generic diagnosis]; Syst. Veg. Fl. Peruv. et Chil. 164. 1798.

Type species, *M. ovata* Ruiz & Pavon,⁵ of Peru.

⁴ This state has been described also as *Capraria lanceolata* Vahl, and *C. semi-serrata* Willd. (above), as *C. hirsuta* H. B. K., Nov. Gen. et Sp. 2: 355. 1818, from Mexico, and as *C. biflora* β *pilosa* Griseb., Fl. Brit. W. I., 427, 1861, from the Bahamas. The first name should be used if this be accounted a distinct species, the last if a variety, and *hirta* if a form.

⁵ *Mecardonia ovata* Ruiz & Pavon, Syst. Veg. Fl. Peruv. et Chil. 164. 1798. "Habitat in Peruviae plateis ad Chinchao et Cuchero vicis." Description appears to be certainly that of *M. procumbens* (Mill.) Small, a wide-spread plant to be expected in Peru. The only discrepancy is in describing the calyx as heptaphyllous, although it is stated that the two small outer leaves are deciduous. Possibly the bractlets at the base of the pedicel were noted approximating the flower in very young buds, or more probably an error of vision was made, and because later it could not be checked the imagined bractlets were considered to be deciduous.

1. *Mecardonia procumbens* (Mill.) Small.

Erinus procumbens Mill., Gard. Dict. ed. VIII. n. 6. 1768. "Houst. MSS."

Herpestis caprarioides H. B. K., Nov. Gen. et Sp. 2: 368. 1818. "Crescit locis arenosis, siccis Regni Novo-Granatensis in ripa fluminis Magdalenae juxta El Peñon [Humboldt & Bonpland]."

Monniera procumbens (Mill.) Kuntze, Rev. Gen. 463. 1891.

Mecardonia procumbens (Mill.) Small, Fl. S. E. Un. St. 1065. 1338. 1903.

Bacopa procumbens (Mill.) Greenm. in Field Col. Mus., Bot. Ser. 2: 261. 1907.

Herpestis procumbens (Mill.) Urb., Symb. Bot. 4: 558. 1911.

Moist open soil, along streams in loam or sand, at altitudes below 1200 meters. Tropical zone, doubtless throughout lowland Colombia, largely as a weed. Also in the Sabana of Bogotá, at an altitude of 2600 meters, probably introduced. Widespread throughout Tropical America.

Antioquia. Opposite Boca Carare (forest along R. Magdalena, alt. 125 m.), Pennell 3829.

Bolívar. Boca Verde on Rio Sinu (field along river, alt. 100–200 m.), Pennell 4568; Cañabetal (sand along river, alt. 90–100 m.), Pennell 3874; Sincelejo (thicket, alt. 150–200 m.), Pennell 4068.

Caldas. Buena Vista (moist open sand, alt. 170–180 m.), Rusby & Pennell 63.

Cúndinamarca. Bogotá (desiccated soil in meadow, alt. 2600 m.), Pennell 1909 [small-leaved form which has been described as *Herpestis chamaedryoides* H. B. K.]; Icononzo (loam slope, alt. 900–1000 m.), Pennell 2777.

Huila. Natagaima (soil frequently overflowed by river, alt. 400–450 m.), Rusby & Pennell 1182; Quebrada de Angeles above Natagaima (gravel, alt. 450–600 m.), Rusby & Pennell 286.

Magdalena. Masinga (damp clearings, alt. 90–750 m.), H. H. Smith 1326 (Y), Agua Dulce, H. H. Smith 1326 (Y).

Meta. Villavicencio (moist meadow along Rio Guatiquia, (alt. 500 m.), Pennell 1556.

Tolima. Honda (moist sandy field, alt. 250–300 m.), Pennell 3620; Libano (field on "La Trinidad," alt. 900–1200 m.), Pennell 3368.

Valle. La Paila, I. F. Holton 579 (Y).

3. *CACONAPEA* Chamisso.

Caconapea Cham. in Linnaea 8: 28. 1833.

Type species *C. gratioloides* Cham., of Brazil.

Pedicels 5–10 mm. long, one to an axil. Corolla 5–7 mm. long, pubescent or puberulent within over base of posterior lobes; lobes violet, throat yellow within, especially on the anterior

side and lined with violet, the posterior lobes united nearly to apex.

Corolla 7 mm. long, pubescent within. Anthers all uniform. Sepals strongly dissimilar, the outer ovate, all puberulent. Capsule septicidal, with thick protuberant placentae, in dehiscence portions of the septum remain adhering to the walls. Seeds conspicuously reticulate. Leaves lanceolate-elliptic, crenate-serrate. Stem sharply quadrangular, 1-3 dm. tall.

1. *C. auriculata*.

Corolla 5 mm. long, puberulent within. Anthers of posterior filaments larger. Sepals slightly dissimilar, the outer lanceolate, all somewhat pubescent. Capsule loculicidal, with thin placentae, placed along median line of the septum which ultimately breaks free from the lateral walls. Seeds finely reticulate. Leaves linear, entire. Stem obscurely quadrangular, .3-.5 dm. tall.

2. *C. debilis*.

Pedicels less than 2 mm. long, usually several to an axil. Corolla 2-3 mm. long, glabrous within; lobes white or violet, throat white and without lines. Placentae thin, attached to median line of septum. Seeds finely reticulate.

Leaves tapering to the narrow base. Stem pilose with spreading white hairs.

3. *C. axillaris*.

Leaves rounded-clasping at base. Stem appressed-pubescent or glandular-dotted.

Corolla deciduous, white throughout, its posterior lobes united nearly to apex. Exterior sepals rounded, all glabrous or obscurely puberulent. Stem whitish with appressed reflexed hairs.

4. *C. appressa*.

Corolla persistent, lobes violet-blue, its posterior lobes united only three-fifths length. All sepals acute, each with a tuft of white hairs at apex. Stem yellowish with sessile glands.

5. *C. conferta*.

1. *Caconapea auriculata* (Rob.) Pennell, comb. nov.

Herpestis auriculata Rob. in Proc. Am. Acad. 26:172. 1891. "Wet places near Guadalajara [Mexico]; November, 1889 [C. G. Pringle] (n. 2937)."

Later collections of Pringle from near Guadalajara, 4623 and 6148, seen in herbarium of Columbia University at The New York Botanical Garden.

Bacopa auriculata (Rob.) Greenm. in Field Col. Mus., Bot. Ser. 2: 262. 1897.

Stem 1-3 dm. tall, sharply four-angled, glabrous to slightly puberulent above. Leaves 1-1.7 cm. long, .5-.8 cm. wide, oblong-lanceolate, crenate, often dentate at and near base, obtuse, rounded-clasping at base; glabrous or glabrate. Pedicels solitary, 5-10 mm. long, puberulent. Bractlets linear-subulate, less than 1 mm. long. Sepals obscurely puberulent: outermost 4 mm. long, ovate, obtuse to acute, obscurely veined; two median slightly shorter and more narrowly ovate; two innermost 3 mm. long, linear-attenuate,

somewhat hyaline. Corolla 7 mm. long; posterior lobes united nearly to apex; pubescent within tube, especially on anterior side, pubescent in horizontal line over bases of posterior lobes; within tube yellow, extending to base of anterior lobes, distally and over lobes violet-blue, with longitudinal fine deep-violet lines. Filaments glabrous, the postero-lateral pair slightly shorter, its anthers equalling those of the antero lateral pair; posterior filament represented by a tiny knob. Style glabrous, at apex bifid and bearing two plate like stigmas. Capsule 2.5-3 mm. long, globose-ovoid, glabrous, dehiscing septicidally, the lateral portions of the septum adhering to the capsule wall. Placentae protruding into the cells, not coalescent. Seeds .4 mm. long, crescentic-cylindric, truncate at the apex, brown, with evident longitudinal lines and cross-reticulations.

Wet open soil, sandy or loam, at altitudes of 500 to 800 meters, Tropical zone, llanos of upper Magdalena valley. Doubtless in the Sabina of Bolívar and elsewhere in northern Colombia. Ranges northward to Mexico.

Cundinamarca. Melgar (moist open clayey loam, alt. 500-600 m.), Pennell 2885.

Huila. Neiva (seepy place in plain, alt. 550-600 m.), Rusby & Pennell 1067.

Tolima. San Lorenzo (open springy loam, w. of, alt. 600-800 m.), Pennell 3531.

2. *Caconapea debilis* Pennell, sp. nov.

Stems ascending, repent and matted below, becoming erect and .3-.5 dm. tall, obscurely four-angled, finely pubescent with reflexed appressed white hairs. Leaves .4-.6 cm. long, .07-.1 cm. wide, linear, obtuse, clasping (but not dilated) at base, nerveless beneath; finely pubescent on the midrib beneath or glabrous throughout. Pedicels solitary, 5-7 mm. long, finely pubescent with reflexed hairs. Bractlets linear-subulate, less than .5 mm. long. Sepals: outermost 3.5 mm. long, linear-lanceolate obtuse; two median slightly shorter but nearly similar, these three green, glabrous or nearly so, except for a frequent terminal tuft of short hairs; the two innermost 3 mm. long, lanceolate-linear, acuminate, with broad scarious margins and ciliate with minute white hairs. Corolla 5 mm. long; posterior lobes united nearly to apex; externally minutely pubescent, within slightly pubescent over bases of the posterior lobes, elsewhere glabrous; within tube pale, yellowish on anterior side, lined with

violet, distally over lobes violet. Filaments glabrous, the postero-lateral pair shorter, its anthers more than twice larger than those of the antero-lateral pair. Style glabrous, with two plate-like stigmas. Capsule 2 mm. long, oblongpyriform, rounded and retuse at apex, glabrous, dehiscent loculicidally. Placentae thin, linear, flattened against the persistent septum. Seeds about .2 mm. long, oval, slightly crescentic, yellowish-brown, obscurely ridged to somewhat reticulate at maturity.

Type, shallow pool in llano, east of Villavicencio, Meta, altitude about 450 meters, collected in flower and fruit September 2, 1917, F. W. Pennell 1623 in herbarium New York Botanical Garden.

Nearest to *Herpestis reptans* Benth. of Brazil, which is described as having leaves .2-.3 cm. wide, linear-lanceolate, prominently nerved beneath, all sepals obtuse and seeds yellow.

Shallow pools in llano, at an altitude of 450 meters, Tropical zone in Meta.

3. *Caconapea axillaris* (Benth.) Pennell, comb. nov.

Herpestis axillaris Benth. in DC. Prod. 10: 396. 1846. "Ad aquas stagnantes in campis Deluvia Sanctae Marthae (Purdie!) . . . (v. in herb. Hook.)."

Monniera axillaris (Benth.) Kuntze, Rev. Gen. 463. 1891.

Tropical zone, in Magdalena. No specimens seen.

4. *Caconapea appressa* Pennell, sp. nov.

Stem .7-1.5 dm. tall, obscurely four-angled, below glabrous, above pubescent with reflexed white hairs. Leaves 1-2 cm. long, .3-.4 cm. wide, lanceolate-linear, entire, tapering from the rounded-clasping base, glabrous, glandular-dotted. Pedicels 1-5 in an axil, 1-2 mm. long, pubescent with reflexed hairs. Bractlets filiform-subulate, less than 1 mm. long. Sepals glabrous, densely glandular-punctate: outermost 3 mm. long, ovate; the next nearly as wide, the median one-sided, narrower, these three obtuse, somewhat reticulate, glabrous; the two innermost narrowly lanceolate, attenuate, costate, with the margins hyaline and ciliolate. Corolla 2-2.5 mm. long; posterior lobes united nearly to apex; glabrous throughout; white throughout. Filaments glabrous, the postero-lateral pair slightly shorter and its anthers slightly smaller. Style glabrous, bearing two approximate stigmas. Capsule 2 mm. long, narrowly cylindric oblong, glabrous, dehiscent septically and loculicidally, none of the septum adhering to the capsule wall. Placentae narrow, thin, a little raised line median to the persistent broad septum. Seeds .5 mm. long, cylindric, tapering to each end, brown, with longitudinal ridges and fine cross lines.

Type, moist depression in llano east of Villavicencio, Meta, altitude about 450 meters, collected in flower and fruit, August 28 and September 2, 1917, F. W. Pennell 1460, in herbarium New York Botanical Garden.

Moist soil, in llanos, at an altitude of 450 meters, Tropical zone, in Meta.

5. *Caconapea conferta* Pennell, sp. nov.

Stem .5-1.8 dm. tall, obscurely four-angled, below glabrous, above puberulent with sessile yellowish glands. Leaves 1-2 cm. long, .2-.4 cm. wide, narrowly lanceolate, tapering from the rounded-clasping base, entire, densely glandular-dotted. Pedicels 1-5 in an axil, less than 1 mm. long, puberulent with sessile glandular dots. Bractlets filiform-subulate, less than 1 mm. long. Sepals densely glandular-puberulent, each tipped with a tuft of white hairs: outermost 3 mm. long, narrowly ovate; two median narrower and one-sided, these three acuminate; two innermost 2.5 mm. long, lanceolate-attenuate, somewhat hyaline-margined and more ciliate. Corolla 3 mm. long; posterior lobes united $\frac{2}{3}$ length; glabrous throughout; its tube white, lobes violet-blue, darker distally within. Filaments glabrous, bluish, the postero-lateral pair slightly shorter; anthers all of about the same size, light-yellow. Style glabrous bearing two stigmas. Capsule 2 mm. long, ellipsoid-oblong, glabrous, dehiscing septicidally and loculicidally, none of the septum adhering to the capsule-wall. Placentae narrow, thin, median to the persistent broad septum. Seeds .3 mm. long, cylindric, slightly irregularly curved, rounded, brown, with fine longitudinal ridges.

Type, moist depression, in llano east of Villavicencio, Meta, altitude about 450 meters, collected in flower and fruit August 28 and September 2, 1917, F. W. Pennell 1435; in herbarium New York Botanical Garden.

Moist soil in llanos, at an altitude of 450 meters, Tropical zone, in Meta.

4. *CONOBEEA* Aublet.

Conobea Aubl., Hist. Pl. Guiane Fr. 2: 639. pl. 258. 1775.

Type species, *C. aquatica* Aubl., of Guiana.

1. *Conobea scoparioides* (C. & S.) Benth.

Sphaerotheca scoparioides Cham. & Schlechtd. in Linnaea 2: 606. 1827.
"E Brasilia aequinoctiali misit Sellow."

Conobea scoparioides (C. & S.) Benth. in DC. Prod. 10: 391. 1846.

Tropical zone, collected only in Choco, but doubtless widespread in northern and eastern Colombia. Widespread through eastern lowland South America.

Choco. Novisa, J. Triana (H, Y).

5. GRATIOLA Linné.

Gratiola L., Sp. Pl. 17. 1753.

Type species, *G. officinalis* L., of Europe.

1. *Gratiola bogotensis* Cortés, sp. nov.

Spreading extensively by rootstocks. Aerial stems erect or decumbent at base, succulent, slightly puberulent, 1-4 dm. tall. Leaves oblong-lanceolate, 1.5-2.5 cm. long, .3-.8 cm. wide, clasping by a rounded base, distally dentate and glandular-punctate, finely puberulent to glabrate. Pedicels 1-2 mm. long. Bractlets similar to and equaling or slightly exceeding the lanceolate calyx-lobes, 5-10 mm. long. Corolla 12-14 mm. long, its tube four-angled, yellowish, with fine brown lines, its lobes spreading, white, somewhat pinkish-tinged or at times the corolla strongly pink. Antero-lateral filaments evident, each capped by two small rudimentary anthers. Capsule ovoid, 5 mm. long. Seeds .5 mm. long, obovoid, conspicuously alveolate-reticulate.

Type, wet grassy place, base of mountain above Chapinero, near Bogotá, Cundinamarca, altitude 2700-2800 meters, collected in flower and fruit September 23, 1917, Pennell 2108 in Herb. New York Botanical Garden. This was collected in company with Sr. Santiago Cortés, who designated it by the name here given.

A near ally or possibly geographical variety, of *Gratiola peruviana* L., Sp. Pl. 17. 1753, based upon Feuillée's description and drawing of a plant found in the mountains of Chile, at 26° S. L. Feuillée's plant is well-matched by a specimen collected by Otto Kuntze in February, 1892, at Ervilla, Chile, and which has the stem less fleshy, the leaves broader and the pedicels slightly longer than does our plant.

Wet grassy places, springheads and ditches. at altitudes of 2600 to 3200 meters, Temperate zone, ascending, in dwarf form, to Paramo, Cordillera Oriental, and Cordillera Central, southward at least into Ecuador.

Cundinamarca. Bogotá (ditch in meadow, alt. 2600 m.), Pennell 1908, (wet grassy place near Chapinero, alt. 2700-2800 m.) Pennell 2108, (southwest of Las Cruces, open spring-head, alt.

2600-2700 m.) Pennell 2158; Sibaté (wet loam, alt. 2700-2800 m.), Pennell 2451; Ubaqué (wet ditch, edge of paramo, alt. 3000-3200 m.), Pennell 1902; Zipaquirá (Mt. Aquila, edge of pool, just below paramo, alt. 3100 m.), Pennell 2532.

Nariño. Tuquerres (alt. 3000 m.), Triana (H, Y).

Tolima. Murillo (pool, alt. 2600-2800 m.), Pennell 3155.

6. **MONOCARDIA**⁶ Pennell, gen. nov.

Stems much branched, terete, repent, the apices ascending. Leaves sessile, slightly clasping, oblong to orbicular, entire, palmately-veined from base, obscurely glandular-dotted and not odorous. Pedicels axillary, 6-20 mm. long, pubescent, not bracteolate. Calyx of 5 very dissimilar sepals; outermost (posterior) heart-shaped; two antero-laterals smaller, obliquely, or but one-half cordate- or truncate-ovate, three outer prominently reticulate; two postero-laterals (innermost) linear-attenuate, only $\frac{2}{3}$ length of outermost and usually slightly longer than the capsule. Corolla 3-7 mm. long, the widely-spreading lobes longer than the tube, the two posterior lobes united nearly throughout; glabrous throughout, blue or white. Stamens four, glabrous, didynamous (the posterior filaments shorter and usually anthers smaller); anthers uniform, the narrow sacs closely connivent, each opening its entire length. Style glabrous, little exceeding the sepals. Stigmas distinct, flat. Capsule 2-4 mm. long, much shorter than calyx, oblong or ovoid-oblong, acute, brown, septicidal and loculicidal; the septum with adherent thin placentae, persisting plate-like. Seeds .2-.3 mm. long, oblong, blackish-brown, ridged and with cross-reticulations.

Type species, *M. violacea* Pennell.

Hydrotrida Small, in general aspect like this genus, differs in possessing a circle of bristles surrounding the ovary, pubescence within over the bases of the corolla-lobes, two bracteoles below the calyx, and more conspicuous glands which exhale a strong aromatic odor. Pedicels and sepals with spreading hairs. Stems and leaves beneath pubescent. Corolla blue.

Corolla 6-7 mm. long. Calyx 5-7 mm. long. Leaves 1.2-1.8 cm. long, and nearly as wide. Stems densely hirsute, 2-3 dm. long.

1. *M. violacea*.

Corolla 4-5 mm. long. Calyx 4-6 mm. long. Leaves .7-1.8 cm. long, ovate-oblong. Stems pubescent, less than 1.5 dm. long.

⁶ Name from *μόνος*, one, and *καρδία*, heart, in allusion to the single large cordate sepal.

Leaves 1.2-1.8 cm. long, the younger pubescent along midrib beneath. Sepals 5-6 mm. long.

2. *M. lilacina*.

Leaves .7-.9 cm. long, the younger pubescent over the entire surface beneath. Sepals 4-5 mm. long.

3. *M. humilis*.

Plant glabrous throughout. Corolla white, 3-3.5 mm. long.

4. *M. albida*.

1. *Monocardia violacea* Pennell, sp. nov.

Stems fleshy, 2-3 dm. long or longer, densely hirsute with yellowish hairs. Leaves ovate- or oval-orbicular, 1.2-1.8 cm. long, 1-1.4 cm. wide, obtuse, pubescent beneath along midrib proximally, distally glabrous and obscurely reticulate. Pedicels 10-20 mm. long, hirsute with spreading hairs. Sepals all ciliate: the three outer 5-7 mm. long, the innermost pubescent on the midrib. Corolla 6-7 mm. long; tube yellow, distally purplish, the lobes violet. Filaments violet-bluish; anthers white. Capsule 3-4 mm. long, narrowly oblong. Seeds .3 mm. long, brown.

Type, wet loam, along trail in forest, near Villavicencio, Meta, altitude 450 meters, collected in flower and fruit August 28, 1917, F. W. Pennell 1480; in Herb. New York Botanical Garden. Only specimen seen.

Wet loam in forest at an altitude of 450 meters. Tropical zone, in Meta, and in Panama. Doubtless wide-spread in northern South America.

2. *Monocardia lilacina* Pennell, sp. nov.

Stems slightly fleshy, .5-1.5 dm. long, pubescent with spreading hairs. Leaves ovate-oblong, 1.2-1.8 cm. long, .8-1.1 cm. wide; obtuse, pubescent beneath along midrib proximally. Pedicels 8-12 mm. long, pubescent with spreading hairs. Sepals all ciliate: the three outer 5-6 mm. long, two innermost pubescent on the midrib, shorter. Corolla 4-5 mm. long, violet within throat, the lobes pale-blue. Filaments of anterior stamens pale-blue, of posterior violet; anthers pale-blue. Capsule 2.5-3 mm. long, ovoid-oblong. Seeds .2-.25 mm. long, blackish.

Type, wet loam, along trail in forest, near Villavicencio, Meta, alt. 450 meters, collected in flower and fruit August 28, 1917. F. W. Pennell 1476; in Herb. New York Botanical Garden.

Wet loam in forest, at altitudes of 450 to 500 meters, Tropical zone, in Meta.

Meta. Villavicencio (wet trail in forest, alt. 500 m.), Pennell 1378, (alt. 450 m.), Pennell 1476, (wet place near Rio Guatiquia, alt. 500 m.), Pennell 1547.

3. *Monocardia humilis* Pennell, sp. nov.

Stems not fleshy, .2-1 dm. long, pubescent with spreading hairs. Leaves ovate-oblong, .7-.9 cm. long, .3-.8 cm. wide, obtuse, at least when young hirsute over entire under surface, not evidently reticulate. Pedicels 6-9 mm. long, pubescent with spreading hairs. Sepals all ciliate: the three outer 4-5 mm. long, pubescent over entire outer surface. Corolla 4-5 mm. long, violet within throat, the lobes pale-blue. Filaments of anterior stamens pale-blue, of posterior violet; anthers pale-blue. Capsule 2-3 mm. long, ovoid-oblong. Seeds .2-.25 mm. long, blackish.

Type, sandy soil, seepy place in plain east of Neiva, Huila, alt. 550-600 meters, collected in flower and fruit August 8, 1917, Rusby & Pennell 1065; in Herb. New York Botanical Garden.

Wet open soil, sandy or loam, at altitudes below 800 meters, Tropical zone, llanos of upper Magdalena valley, and in Panama. Doubtless in the Sabana of Bolívar.

Huila. Neiva (sandy seepy place in plain east of N., alt. 550-600 m.), Rusby & Pennell 1065.

Tolima. San Lorenzo (swale west of S. L., alt. 600-800 m.), Pennell 3544.

4. *Monocardia albidula* Pennell, sp. nov.

Stems not fleshy, .3-1.5 dm. long, glabrous. Leaves ovate-oblong, .7-1.5 cm. long, .3-1 cm. wide, obtuse, glabrous. Pedicels 7-14 mm. long, glabrous. Sepals glabrous: the three outer 4-5 mm. long. Corolla 3-3.5 mm. long, dull white throughout. Filaments and anthers white. Capsule 2-3 mm. long, narrowly elliptic-oblong. Seeds .2-.3 mm. long, blackish.

Type, wet loam, trail in forest, Villavicencio, Meta, alt. 450 meters, collected in flower and fruit August 28, 1919, F. W. Pennell 1477; in Herb. New York Botanical Garden.

Wet loam in forest at altitudes of 450 to 500 meters, Tropical zone, in Meta.

Meta. Villavicencio (wet trail in forest, alt. 450 m.), Pennell 1477, (moist meadow near Rio Guatiquia, alt. 500 m.), Pennell 1555 (plant much smaller than 1477).

7. *MACUTILLAMIA* Rafinesque.

Macutillamia Raf. [Neogenyton 2.1825, generic description only.] Autik. Bot. 44, 1840.

Type species, *Monniera rotundifolia* Mich., of Illinois.

1. *Macuillamia limosa* Pennell, sp. nov.

Extensively repent. Stem slightly succulent, finely pubescent rather densely so distally. Leaves 1.2–1.7 cm. long, 8–10 mm. wide obovate-elliptic, entire, narrowed at base, rounded at apex, with 7 or 9 longitudinal veins. Pedicels slender, 10–15 mm. long, finely pubescent, in flower ascending, soon reflexing below the leaf-like bracts. Sepals 2.5–3 mm. long, obtuse, somewhat pubescent; two outer ovate-oblong; two median lanceolate-oblong; the innermost one narrower or wanting. Corolla 4 mm. long, the lobes spreading, slightly longer than the tube, the two posterior united to apex; glabrous throughout, white. Filaments white. Anthers purplish. Styles distinct near apex; stigmas semi-capitate. Capsule 2–2.5 mm. long, nearly globose, obtuse. Seeds .6 mm. long, cylindric-oblong, reticulate, brown.

Type, open pool in clayey loam, Melgar, Cundinamarca, altitude 400–500 meters, collected in flower and fruit December 4–5, 1917, F. W. Pennell 2927; in Herb. New York Botanical Garden.

Open pools and ditches, in shallow still water, at altitudes below 500 meters, Tropical zone, in the Magdalena and Cauca valleys, and doubtless through northern Colombia. Ranges northward to Mexico.

Antioquia. Puerto Berrio (shallow water, alt. 125–135 m.), Rusby & Pennell 32.

Cundinamarca. Melgar (pool in clayey loam, alt. 400–500 m.), Pennell 2927.

Tolima. Espinal to Cuamo (ditch, loam, alt. 350–400 m.), Rusby & Pennell 179.

Valle. La Paila, I. F. Holton 581 (H, Y).

8. *HYDRANTHELIUM* Humboldt, Bonpland and Kunth.

Hydranthelium H. B. K., Nov. Gen. et Sp. 7: 202. pl. 646. 1825.

Type species, *H. callitrichoides* H. B. K., of Venezuela.

1. *Hydranthelium braunii* Ernst.

Hydranthelium braunii Ernst, in Vargasia 1: 189. 1870.

"Hallé el 19 de Setiembre de 1869 en uno de los pozos de la sabana delante el camposanto de la Merced [Caracas]," Venezuela.

Open wet soil, at an altitude of 30 meters, Tropical zone, in Magdalena; doubtless eastward near the Caribbean coast through Venezuela.

Magdalena. El Libano plantation, (Santa Marta region, open land on border of swamp and flooded during heavy rains, alt. 30 m.),

H. H. Smith 2544 (C, H, U, Y). (Plants small, largest .8 dm. long, and in flower only, youngest leaves slightly undulate-lobed.)

9. SCOPARIA Linné.

Scoparia L., Sp. Pl. 116. 1753.

Type species, *S. dulcis* L.

1. *Scoparia dulcis* L.

Scoparia dulcis L., l. c. 116. 1753. "Habitat in Jamaica, Curassao"; ex L., Hort. Cliff. 320. 1737. "Crescit in Curassao & Jamaica." No specimens from Curaçao seen but the plant here considered unquestionably occurs there.

Capraria dulcis (L.) Kuntze, Rev. Gen. 459. 1891.

Open soil, loam or sand, river-banks, fields, along trails and in towns, at altitudes below 1500 meters, Tropical zone, doubtless throughout lowland Colombia. Ranges throughout Tropical America, a weed of South American origin.

Antioquia. Vuelta de Acuña on Rio Magdalena (sandy loam shore, alt. 125–130 m.), Pennell 3790.

Bolívar. Boca Verde on Rio Sinu (cacaotale, alt. 90–120 m.), Pennell 4233; Buenavista, east of Sincé (open grassy place), Pennell 3991; Calamar (along Rio Magdalena, alt. 15–25 m.), Rusby & Pennell 17; Vilches on Rio Sinu (loam, alt. 20–50 m.), Pennell 4713.

Cundinamarca. Girardot (field, alt. 350–400 m.), Rusby & Pennell 113; Pandi (open slope, alt. 900–1100 m.), Pennell 2816.

Huila. Cordillera Oriental, east of Neiva (open foot-hill, alt. 700–1500 m.), Rusby & Pennell 460.

Magdalena. Bonda (alt. 45 m., common weed in open places below 900 m.), H. H. Smith 1330 (C, H, U, Y).

Meta. Villavicencio (streets, alt. 525 m.), Pennell 1372, (roadside, alt. 500 m.), Pennell 1572.

Tolima. Libano (field, alt. 700–900 m.), Pennell 3426.

Valle. La Paila, I. F. Holton 587 (Y).

10. STEMODIA Linné.

Type species, *S. maritima* L., of Jamaica.

Stemodia L., Syst. Nat. ed. X, 1118. 1759.

1. *Stemodia durantifolia* (L.) Sw.

Capraria durantifolia L., Syst. Nat. ed. X. 1116. 1759. " . . . Sloan. Jam. t. 174." Ex Sloane, Jam. 196. pl. 124. f. 2: "Grows in the sandy savannas [of Jamaica]."

Stemodia durantifolia (L.) Sw., Obs. Bot. 240. 1791.

Stemodacra durantifolia (L.) Kuntze, Rev. Gen. 466. 1891.

Occurs in two color-forms, blue, and lavender or "pale-pink."

River-flats and moist, or frequently desiccated, ditches, in open land, at altitudes below 500 meters, Tropical zone, near the Caribbean Coast, along the Rio Magdalena and on the Sabana of Bolívar. Ranges from Mexico to Brazil and in the West Indies.

Antioquia. Brazuela de Perales (river flat along Rio Magdalena, alt. 150 m.), Pennell 3698 [corolla blue].

Bolívar. Cartagena (moist arroyo, 12 km. s. e. of C., alt. 50–100 m.), Pennell 4729 [corolla blue], (open ditch, 14 km. s. e. of C., alt. 50–100 m.), Pennell 4730 [corolla lavender]; Sincé (desiccated pool in prairie, alt. 120–170 m.), Pennell 4047 [corolla lavender].

Huila. Quebrada de Angeles, above Natagaima (alt. 450–500 m.), Rusby & Pennell 263 [corolla blue].

Magdalena. Carpentiera (along Rio Magdalena, alt. 50–60 m.), Rusby & Pennell 28; Mamatoca (open boggy ground, 5 m. s. of M., alt. 30 m.), H. H. Smith 1360 (C, H, U, Y) [corolla pale pink].

11. **UNANUEA** (Ruiz and Pavon.) gen. nov.

Unanuea R. & P., (Ic. Fl. Per. Ined.),

Erect, much-branched shrubby herbs or low shrubs, at least 8–10 dm. tall. Stems 4-angled. Leaves mostly whorled in threes, lanceolate to ovate, acute to acuminate, serrate to dentate, shortly petioled. Pedicels axillary, slender, as long as or longer than the calyces, not bracteolate. Sepals five, uniform, linear to lanceolate, entire. Corolla 9–13 mm. long, tubular-campanulate with spreading lobes, the posterior united three-fourths length; externally puberulent, within glabrous, purple-blue. Stamens four, didynamous (the posterior filaments shorter), glabrous, anthers-sacs elliptic, each stalked on a short arm of the connective. Style glabrous. Stigmas distinct, flattened. Capsule brown, ovate in outline, acuminate, dehiscent septicidally (even through septum) and slightly also loculicidally; placentae adherent to septum, roughened by funicles. Seeds oblong, minutely roughened-tubercular.

Differs from *Stemodia* L., which has corolla-lobes not widely spreading, pubescent or glabrous within on the anterior side, two bracteoles on the pedicel beneath the calyx, and the leaves sessile and clasping; from *Lendneria* Minod, which are herbs low and spreading, with smaller corollas densely pubescent within over the bases of the posterior lobes and with evidently petioled leaves. Both *Stemodia* and *Lendneria* are genera of the Tropical life-zone, while *Unanuea* is of the Subtropical and Temperate zones.

Type species, *Stemodia suffruticosa* H. B. K., of Ecuador.

1. *Unanuea dentata* (Minod) Pennell, comb. nov.

Stemodia suffruticosa H. B. K., f. *dentata* Minod in Bull. Soc. Bot. Genève ser. II. 10: 201. 1918. "In Andibus Ecuadorensibus (R. Spruce, n. 5066!)." Isotype seen in Gray Herbarium of Harvard University.

At an attitude of 2600 meters, Temperate zone, southern Cordillera Central southward into Ecuador.

Cauca. Mozoco, Moras Valley, Tierra Adentro (alt. 2600 m.), H. Pittier 1326 (U). ["A shrub, 1 m. high; fl. deep purple."]

12. *LENDNERIA* Minod.

Lendneria Minod, in Bull. Soc. Bot. Genève, ser. II. 10: 240. 1918.

Type species, *Capraria humilis* Soland.

Pedicels 1-2 mm. long. Corolla 4 mm. long, its lobes blue, the posterior united two-thirds length. Hairs within corolla over base of posterior lobes not knobbed. Anther-sacs circular, slightly separated on very short connective-arms. Capsule globose, 2 mm. long, much shorter than the sepals. Seeds pale yellowish, nearly cylindric. 1. *L. humilis*.

Pedicels longer, mostly 7-20 mm. long. Corolla 8 mm. long, its lobes white, the posterior united nearly to apex. Hairs within corolla over base of posterior lobes knobbed. Anther-sacs oblong, distinctly separated on stout connective-arms. Capsule in outline oblong-ovate, 4-5 mm. long, about equaling the sepals. Seeds brown-black, nearly oblong. 2. *L. angulata*.

1. *Lendneria humilis* (Soland.) Minod.

Capraria humilis [Soland. in] Ait., Hort. Kew. 2: 354. 1789. "Nat. of the East Indies. John Gerard Koenig, M.D. Introd. 1781, by Sir Joseph Banks, Bart." Identified by Bentham in DC. Prod. 10: 383. 1846, as species here considered, his determination with an "!" Our plant has been occasionally reported as an introduction into the Old World Tropics.

Stemodia parviflora Ait., Hort. Kew., ed. II. 4: 52. 1812. "Nat. of South America. Cult. 1759 by Mr. Ph. Miller." Miller's plant was derived from Houston who collected at Cartagena in Colombia as well as in Mexico and the West Indies. The original introduction of Houston, published as *Erinus verticillatus* Mill., Gard. Dict. n. 5. 1768, differs so essentially from the account of Aiton's plant, especially in denoting a plant with glabrous stems and leaves, as to lead to the supposition that the latter was described from specimens of a different origin.

Stemodia arenaria H. B. K., Nov. Gen. et Sp. 2: 357. pl. 175. 1818. "Crescit in ripa inundata fluminis Magdalenae prope Banco et El Peñon inter Mompox et Morales."

Lendneria humilis (Solander) Minod in Bull. Soc. Bot. Genève, ser. II. 10: 240. 1918.

Corolla-tube yellowish, lobes blue-violet, tube and lobes, especially on the posterior side, with deep violet lines. Seen also (Pennell 4709) with corolla very pale, a distinct color-form.

Moist soil, river-banks and waste-land, frequently a weed near habitations, at altitudes below 200 meters, Tropical zone, along the

Rio Sinu in Bolívar, the Rio Cauca in Valle, and the Rio Don Diego in Magdalena; doubtless wide-spread elsewhere. Ranges from Mexico to Argentina and in the West Indies.

Bolívar. Boca Verde, on Rio Sinu (gravelly river-bank, alt. 90–120 m.), Pennell 4197, (field along river, alt. 100–200 m.), Pennell 4567; Frasuquillo, on Rio Sinu (grove along river in village, alt. 90–120 m.), Pennell 4610; Vilches, on Rio Sinu (shaded yard, alt. 20–50 m.), Pennell 4708 [corolla blue], 4709 [corolla pale-blue], 4710 [corolla intermediate in color between 4708 and 4709].

Magdalena. Open sandy ground by the Rio Don Diego, near the sea, H. H. Smith 2730 (Y).

Valle. La Paila, I. F. Holton 580 (H, Y).

2. *Londneria angulata* (Oersted) Pennell, comb. nov.

Stemodia angulata Oersted in Kjoeb. Vidensk. Meddel. 1853: 22. 1853.
"I Naerheden af Cartago i Costa-Rica."

Certainly distinct from *Stemodia jorullensis* H. B. K., Nov. Gen. et Sp. 2: 358. 1818, which is described as 1–1½ feet tall and with leaves in threes, incised or doubly serrate.

Moist soil in shade, river-banks and waste land, at altitudes below 600 meters, Tropical zone, along the Rio Sinu in Bolívar, and in Magdalena; doubtless wide-spread in northern Colombia. Ranges northward to Guatemala.

Bolívar. Frasuquillo, on Rio Sinu (shady soil along river, alt. 70–100 m.), Pennell 4192.

Magdalena. Minca (damp door-yard, in crevices of bricks, alt. 600 m.), H. H. Smith 1328 (C, H, U, Y).

13. *VANDELLIA* Browne.

Vandellia Browne; L., Mant. Pl. 1: 12, 89. 1767.

Type species, *V. diffusa* L.

1. *Vandellia diffusa* L.

Vandellia diffusa L., Mant. Pl. 1: 89. 1767. "Habitat in Insula S. Thomae. D. D. Browne." Description inaccurate in describing the calyx as quadripartite (but with upper lobe subbifid), its lobes equal, the lower lip of corolla as bilobed, and the capsules as one-celled, but is nevertheless certified by Bentham, DC. Prod. 10: 416. 1846 as being the plant here considered.

Lindernia diffusa (L.) Wettst. in Nat. Pflanzenfam. 43b: 79. 1891.

Pyxidaria diffusa (L.) Kuntze, Rev. Gen.: 464. 1891.

Moist open soil, along trails and in towns, at altitudes below 1500 meters, Tropical zone; widely distributed through tropical America, in situations to suggest its having been naturalized. Ap-

parently introduced from the Ethiopian Region of the Old World Tropics.

Cundinamarca. Icononzo (along trail in forest, alt. 1400–1800 m.), Pennell 2871.

Magdalena. River Don Diego (open sandy wet ground near sea, alt. 0–10 m.), H. H. Smith 2729 (H, Y).

Meta. Villavicencio (moist depression in llano, e. of, alt. 450 m.), Pennell 1466; (streets of town, alt. 525 m.), Pennell 1575, (gravel along Rio Guatiquia, alt. 500 m.), Pennell 1590.

Tolima. Mariquita (prairie, depression, alt. 250–300 m.), Pennell 3639.

14. *TORENIA* Linné.

Torenia L., Sp. Pl. 619. 1753.

Type species, *T. asiatica* L., of India.

Bracts leaf-like, the upper smaller; inflorescence an elongate raceme.

Pedicels 20–25 mm. long. Sepals 4–5 mm. long. Corolla 5–7 mm. long, its posterior lobes united $\frac{3}{4}$ – $\frac{1}{2}$ length and equaling the anterior; anterior lobes widely horizontally spreading; within glabrous, blue on posterior lobes and distally on anterior lobes, these yellowish-white proximally with an arch of deep-violet at the base of the anterior lobes. Capsule 3–4 mm. long, obtuse and mucronate. Leaves ovate, 1–1.5 cm. long. Plant repent-ascending.

1. *T. crustacea*.

Bracts minute, subulate; inflorescence congested at the nodes.

Pedicels 10–15 mm. long. Sepals 9–11 mm. long. Corolla 8–9 mm. long, its posterior lobes united nearly to apex and shorter than the anterior lobes; antero-lateral lobes placed sagittally, the anterior lobe horizontal and longest; within pubescent over bases of anterior lobes, white or on anterior side somewhat blue-violet. Capsule 8–10 mm. long, acute. Leaves lanceolate-ovate, 1.2–2.5 cm. long. Plant ascending-erect.

Corolla on anterior lobe blue-violet, and on antero-laterals with blue-violet streaks. Leaves dentate. 2. *T. thouarsii*.

Corolla white throughout. Leaves crenate-serrate.

2a. *T. thouarsii nivea*.

1. *Torenia crustacea* (L.) Cham. & Schlecht.

Capraria crustacea L., Mant. 87. 1767. "Habitat in Amboina; China." Amboina plant, described by Rumphius, Herb. Amb. 5: 461. pl. 170 f. 3, verified by Dr. E. D. Merrill, Interp. Rumph. Herb. Amb. 468, as the plant here considered.

Torenia crustacea (L.) C. & S. in Linnaea 2: 570. 1827.

Vandellia crustacea (L.) Benth., Scroph. Ind. 35. 1835.

Lindernia crustacea (L.) F. Muell., Census 97. 1882.

Pyxidaria crustacea (L.) Kuntze, Rev. Gen. 2: 464. 1891.

Moist open soil, along trails and in towns, at altitudes of 500 to 600 meters, Tropical zone; introduced from Oriental Region of Old World Tropics.

Cundinamarca. Melgar (moist loam, open slope, along trail, alt. 500-600 m.), Pennell 2878, 2879 [form smaller throughout].

Meta. Villavicencio (streets and yards, alt. 525 m.), Pennell 1527.

2. *Torenia thouarsii* (Cham. & Schlecht.) Kuntze.

Nortenia thouarsii Cham. & Schlecht. in *Linnaea* 3: 18. 1828. "In Brasiliae provincia Rio Janeiro in uliginosis post Botafoginam . . . legit Beyrich, in insulis Madagascaria et Mauritii Depetit Thouars. . . Willd. Hb. n. 11,547 (planta madagascariensis a Thouarsii comm.)."
Torenia nortenia Steud., *Nom.*, ed. II. 2: 692. 1841.
Torenia thouarsii (Cham. & Schlecht.) Kuntze, *Rev. Gen.* 468. 1891.

This has usually been known as *Torenia parviflora* Ham.

Moist banks, in edge of forest, at an altitude of 500 meters, Tropical zone; wide-spread through lowland tropical South America, growing as if a native plant. However, as this American plant appears to be indistinguishable from the plant of the Old World, and the remaining species of the genus are all Palaetropic it appears nearly certain that our plant is an introduction. From the Ethiopian and Oriental regions of the Old World Tropics.

Meta. Villavicencio (moist shaded bank near Rio Guatiquia, alt. 500 m.), Pennell 1528, (moist meadow and swamp in forest, near Rio Guatiquia, alt. 500 m.), Pennell 1560.

2a. *Torenia thouarsii nives* Pennell, var. nov.

Leaves smaller, 1.2-1.5 cm. long, crenate-serrate, rather than dentate. Corolla white throughout. Probably a color-form identical with plants of the Old World Tropics and introduced therefrom.

Type, wet sand along Rio Guatiquia, altitude 500 meters, collected in flower and fruit August 30, 1917, F. W. Pennell 1531; in herbarium New York Botanical Garden.

15. *ILYSANTHES* Rafinesque.

Ilysanthes Raf., *Ann. Nat.* 13. 1820.

Type species, *I. riparia* Raf., of the Ohio.

1. *Ilysanthes inaequalis* (Walt.) Pennell.

Gratiola inaequalis Walt., *Fl. Carol.* 61. 1788. [South Carolina.]
Ilysanthes inaequalis (Walt.) Pennell in *Torrey* 19: 149. 1919.

Wet soil near streams, at an altitude little above sea-level, Tropical zone, in Magdalena. Probably wide-spread, and also in the

Subtropical and Temperate zones. Through lowland South America south to Paraguay; ranges northward into Temperate North America.

Magdalena. Rio Buritaca (observed only in a swampy place, bank of R. B., close to the sea—50 m. e. of Santa Marta), H. H. Smith 1329 (C, H, U, Y).

16. *SCHISTOPHRAGMA* Benth.

Schistophragma Benth. in DC. Prod. 10: 392. 1846

Type species, *S. pusilla* Benth.

1. *Schistophragma pusilla* Benth.

Schistophragma pusilla Benth. in DC. Prod. 10: 392. 1846. "In Mexico pr. Tehuantepec (Alaman!) . . . (v. s. comm. a. cl. DC.)." Description from a dwarf plant, which explains the variety following.

Schistophragma pusilla major Benth., l. c. 392. 1846. "In campis aridis pr. Sta Martha (Purdie!) . . . (v. in herb. Hook.)."

Conobea pusilla (Benth.) B. & H., Gen. 2: 951. 1876.

Open dry, stony soil, at altitudes below 300 meters, Tropical zone, in Magdalena, and doubtless spread across northern Colombia. Ranges northward to Mexico.

Magdalena. Bonda (alt. 60 m.), H. H. Smith 1970 (C, H, U, Y).

["Rare on open, stony and dry ground, hillsides or banks below 1000 f."]

17. *MIMULUS* Linné.

Mimulus L., Sp. Pl. 634. 1753.

Type species, *M. ringens* L., of Virginia.

1. *Mimulus glabratus* H. B. K.

Mimulus glabratus H. B. K., Nov. Gen. et Sp. 2: 370. 1818. "Crescit prope Moran Mexicanorum, alt. 1330 hex. [= 2527 m.]. Varies, even in same colony, with leaves obviously petioled or nearly sessile, and with all parts of the plant, including the flower, relatively large or relatively small. The latter state is doubtless the basis of *M. andicola* H. B. K. from Ecuador.

Corolla lemon-yellow, within throat on anterior side golden and spotted with many red-brown spots.

Along streams, springheads, swales and brooks, at altitudes of 2300 to 3200 meters, Temperate zone, ascending as a dwarfed plant to Paramo, and descending rarely into the Subtropical zone, both slopes of Cordillera Oriental, in Cundinamarca. Doubtless throughout this and the other Cordilleras. Ranges through the Andes southward to Bolivia and with many breaks, through the mountains of Central America and Mexico, northward to Colorado and the plains of North Dakota.

Cundinamarca. Bogotá (ditch in field near Rio San Cristobal, alt. 2800 m.), Pennell 2194, 2279, (wet open spring-head, alt. 2700–2800 m.), Pennell 2296; Chipaque (wet roadside, alt. 2300–2400 m.), Pennell 1326; Sibaté (wet roadside, alt. 2620 m.), Pennell 2387; Zipaquirá (springhead in meadow, alt. 2650 m.), Pennell 2533; Mt. Chuscal, west of Zipaquirá (swale on paramo, alt. 3100–3200 m.), Pennell 2600; Guasca (alt. 2700 m.), Triana.

18. *LEUCOCARPUS* D. Don.

Leucocarpus D. Don in Sweet, Brit. Flow. Gard. II. pl. 124. 1831.

Type species, *Conobea alata* Graham, of Mexico.

1. *Leucocarpus perfoliatus* (H. B. K.) Benth.

Mimulus perfoliatus H. B. K., Nov. Gen. et Sp. 2: 371. 1818. "Crescit in Regno Novo-Granatensi. . . . A Mutisio cum Bonplandio communicatus." Described as with leaves connate, but this appearance has misled subsequent workers, including Benthham in his characterization of *Leucocarpus*. The plant actually has opposite cordate-clasping leaves. *Leucocarpus perfoliatus* (H. B. K.) Benth. in DC. Prod. 10: 335. 1846.

This species has usually been called *L. alatus* (Graham) D. Don, based upon *Conobea alata* Graham (1830) of Mexico, a plant more carefully described and under an appropriate name. The character of length of calyx-lobes, used by Benthham, is of no significance, the lobes varying in the same specimens and usually seeming relatively longer when in the bud.

Corolla yellow throughout, with two pubescent ridges within throat anteriorly. Plant shrubby below, from a perennial root sending up a clump of many long densely floriferous stems. Fruit fleshy, chalky-white.

Along stream banks in forest, at altitudes of 1350 to 2000 meters, probably from all slopes of the Cordilleras, and also on the Sierra Nevada de Santa Marta. Subtropical zone. Ranges from Mexico to Bolivia. The seeds are doubtless carried by birds.

Huila. Cordillera Oriental, east of Neiva (along rocky stream in forest, alt. 1500–2000 m.), Rusby & Pennell 600.

Magdalena. Las Nubes (damp clearing near stream, alt. 1350 m.), H. H. Smith 1405 (C, H, U, Y).

Tolima (?). "Forets de Quindio" (2200 m.), J. Triana (U).

Valle. Jicaramata, "circum flumen Toluam", I. F. Holton 578.

19. *ALONSOA* Ruiz and Pavon.

Alonsoa R. & P., Syst. Veg. Fl. Peruv. et Chil. 150. 1798.

Type species, *A. caulialata* R. & P., of Peru.

Leaves coarsely serrate or dentate, the largest 5–6 cm. long. Corolla 10 mm. long. Filaments thick. Anthers infundibuliform-

explanate. Capsule 9–10 mm. long, narrowly ovoid, conspicuously attenuate. Seeds black, the furrows nearly as wide as the intervening ridges. Stem above, pedicels and calyces usually glabrous, rarely somewhat glandular-pubescent.

1. *A. meridionalis*.

Leaves uniformly serrate, the largest 8–9 cm. long. Corolla 5–6 mm. long. Filaments thin. Anthers widely and flatly explanate. Capsule 6 mm. long, pyramidal, shortly attenuate. Seeds dark-brown, the furrows much narrower than the intervening ridges. Stem above, pedicels and calyces glandular-pubescent, densely pubescent at the bases of the petioles.

2. *A. serrata*.

1. *Alonsoa meridionalis* (L. f.) Kuntze.

Scrophularia meridionalis L. f., Suppl. 280. 1781. "Habitat in Nova Granada. D. Mutis." Type probably from Bogotá.

Hemimeris mutisii H. B. K., Nov. Gen. et Sp. 2: 376. 1817. "Crescit prope Santa Fe de Bogota [Humboldt & Bonpland]."

Alonsoa mutisii (H. B. K.) G. Don, Gen. Syst. 4: 513. 1838.

Alonsoa meridionalis (L. f.) Kuntze, Rev. Gen. 2: 457. 1891. The plant of Venezuela noted by Kuntze, and described as so variable in color, is *A. parviflora* (H. B. K.) G. Don.

Corolla uniformly dull-orange. Filaments dull-yellow. Anthers yellow.

Waysides and grassy slopes, around the margins of the Sabana of Bogotá, on the western slope of the Cordillera Oriental; at altitudes of 2600 to 2900 meters. Temperate zone.

Cundinamarca. Zipaquirá, Pennell 2564 (Y); Bogotá, Holton (Y), Pennell 1309 (Y), Pennell 2099 (Y), Pennell 2332 (Y); (Plateau de Bogotá), J. Triana (Y); El Peñon, s. w. of Sibaté, Pennell 2410 (Y), [pedicels unusually glandular-pubescent].

2. *Alonsoa serrata* Pennell, sp. nov.

Stem 6 dm. tall, four-angled, angles slightly winged, stem glabrous below, glandular-pubescent above. Leaves opposite, 8–9 cm. long, the blades ovate, uniformly serrate, slightly paler beneath, glabrous, on petioles less than one-half length of blade. Racemes indefinite, terminal on the stem and branches; bracts sessile, the lowermost ovate and somewhat serrate, nearly 2 cm. long, the upper lanceolate, smaller. Pedicels spreading, 10–11 mm. long, glandular-pubescent. Sepals oblong-lanceolate, acute, glandular-pubescent, 3–4 mm. long. Corolla 5–6 mm. long. Filaments slender. Anthers widely explanate. Style 2–2.5 mm. long. Stigma capitate. Capsule 6 mm. long, pyramidal, slightly attenuate to an obtuse apex, glabrous. Seeds .8–.9 mm. long, cylindric, dark-brown, with about 8 rounded longitudinal ridges separated by deep narrow furrows; the whole surface finely alveolate-reticulate.

Type, Santa Marta Mountains, collected in flower and fruit about April, 1899, H. H. Smith 1497; in Herb. New York Botanical Garden. The note for 1497 is stated by Smith to have been lost, but he tells us that the plant is "probably from Valparaiso, 4500 ft. [= 1350 m.]" altitude. I suspect that this plant came from much higher than this.

Rusby has compared this with Purdie's plant from Santa Marta and has written on our sheet "Purdie's plants are more hairy than this," an excellent confirmation of Purdie's specimens cited in DC. Prod. 10. 250: being this same species.

Magdalena. Valparaiso, Santa Marta Mts., H. H. Smith 1497 (C, H, U, Y).

20. *FAGELIA* Schwencke.

Fagelia Schwencke, [in Verh. Bataafsh. Genootsch. Rotterdam 1: 474. pl. 13. 1774, generic diagnosis only]; J. F. Gmel., Syst. Nat. 40. 1791.
Calceolaria L., in Kongl. Vetensk. Acad. Handl. 31: 288, 1770, not *Calceolaria* Fabr., Enum. Meth. Pl. Host. Med. Helmstad. ed. II. 37. 1763.

Type species, *F. flavicans* J. F. Gmel., probably from Ecuador.

Anther-sacs proximate on the simple filament, both alike and fertile.

Anterior lip of corolla (= sac) not over twice width of posterior lip (= hood). Leaves entire to coarsely serrate-dentate, the blades at times triangular. [CHEILONCOS Kranzl.]

Capsule ovate or broader, no longer than broad, thick-walled, shorter than or but slightly exceeding the sepals. Corolla 8-25 mm. long, with the posterior lip broadly truncate to notched. Filaments stout, not or but little longer than the oblong anthers. Inflorescence corymb-like, both secondary branches developed, and at least some of the lateral flowers without bracts.

Shrubs. Glutinous above, on stems, pedicels, sepals and leaves. Leaf-blades lanceolate, entire to slightly serrate, shortly petiolate. Corolla appearing broader than long because the sac is pressed tightly against hood; orifices to lips broad and rounded, so sac is shallow.

Calyx 4-6 mm. long. Leaves glaucous beneath. Plant less glutinous. Branches of the inflorescence once branched, so that flowers occur in fours. 1. *F. microbefaria*.

Calyx 2-3 mm. long. Leaves slightly paler beneath. Plants very glutinous. Branches of the inflorescence irregularly twice branched, so that flowers occur usually in clusters of more than four. 2. *F. fruticosa*.

Herbaceous throughout. Not glutinous, but often with stalked glands. Leaf-blades lanceolate to broadly triangular, serrate to doubly dentate. Corolla evidently elongated sagittally, with sac usually not pressed against hood and so

with its orifice evident; orifice to hood narrow, or truncate; to sac truncate, with sac deep.

Calyx 4-5 mm. long, shorter than or about equaling the capsule. Leaves sessile. Stem densely glandular-pubescent.

Leaves narrowed at base, elliptic-lanceolate, dentate, on both surfaces densely ferruginous-pubescent with dark-jointed hairs. Stem below densely, above sparsely pubescent. Inflorescence of a few wide-spreading branches. Corolla 8-10 mm. long. Anthers about 1.5 mm. long.

3. *F. lehmanniana*.

Leaves rounded-clasping at base, lanceolate, crenate-serrate (with spinulose serrations), above glabrate, beneath paler and finely pubescent. Stem below apparently glabrate, above pubescent with short gland-tipped hairs. Corolla about 12-15 mm. long. Anthers about 2.5 mm. long.

4. *F. crenata*.

Calyx 7-12 mm. long, longer than the capsule. Leaves petioled, petiole at times broadly winged.

Anther-sacs stiffly divaricate (so anthers straight), opening throughout or from distal apices. Capsule with gland-tipped hairs. Corolla slightly pubescent within at base. Style 1.5-4 mm. long. Wing of petiole less than one-third width of blade or wanting.

Leaves 3-5 mm. long, the petioles wingless.

Stem pubescent throughout with glandless hairs.

Calyx-lobes obtuse to acute. Corolla 15-20 mm. long. Style 1.5 mm. long. Leaves 3-4 cm. long, obtuse to acutish, simply or somewhat doubly crenate-serrate, beneath pale and densely pubescent. Secondary branches of the inflorescence not or scarcely branched.

5. *F. saxatilis*.

Stem pubescent distally with gland-tipped hairs.

Calyx-lobes acuminate. Corolla about 10 mm. long. Style 3 mm. long. Leaves 4-5 cm. long, acuminate, irregularly somewhat doubly serrate with acute teeth, beneath lighter green and somewhat pubescent. Secondary branches of the inflorescence repeatedly branched.

6. *F. bogotensis*.

Leaves 11-17 cm. long, the petioles winged proximally or throughout, the wing connate with that of opposite leaf.

Petioles broadly winged proximally, distally very narrowly margined; leaf-blades broader than long, irregularly shallowly crenate-dentate. Corolla with posterior lobes not united to apex, so leaving a deep narrow orifice into hood. Anther-sacs broadly contiguous.

7. *F. trilobata*.

Petioles nearly uniformly winged throughout; leaf-blades longer than broad, sharply doubly serrate-dentate. Corolla with posterior lobes united nearly or quite to apex, so leaving slight if any median orifice into hood. Anther-sacs narrowly contiguous.

Corolla 8–10 mm. long; hood with slight median orifice. Anthers 2 mm. long, the sacs opening throughout. Style 1.5–1.8 mm. long. Capsule 3–4 mm. long. Winged petiole usually 12–18 mm. wide, and somewhat dentate. Plant pubescent above with some gland-tipped hairs.

8. *F. alata*.

Corolla 13–15 mm. long; hood truncate, without apical median orifice. Anthers 3.5 mm. long, the sacs opening from distal apex but not throughout. Style 4 mm. long. Capsule 5–6 mm. long. Winged petiole 8–13 mm. wide, entire. Plant pubescent throughout with glandless hairs.

9. *F. nevadensis*.

Anther-sacs curved (so anther horseshoe-shaped), opening from proximal apices partially or throughout. Capsule pubescent with glandless hairs. Corolla glabrous within at base. Style 5 mm. long. Wing of petiole more than one-third width of blade.

Leaves sharply dentate, above glabrate, beneath paler and finely pubescent. Stem glabrate below, somewhat hirsute above. Calyx 8–10 mm. long.

10. *F. tolimensis*.

Leaves obtusely dentate, above pubescent, beneath softly pubescent to tomentose. Stem hispid below, hirsute-pubescent above. Calyx 9–11 mm. long.

11. *F. perfoliata*.

Capsule narrowly pyramidal, longer than broad, thin-walled, nearly twice as long as the sepals. Corolla 5–6 mm. long, nearly globose, with posterior lip attenuate to a shallowly notched apex. Filaments slender, several times longer than the hemispheric anthers. Inflorescence appearing as if with flowers axillary, normally one secondary branch developing repeatedly through an indefinite number of nodes.

12. *F. ovata*.

Anther-sacs separated on two arms of the connective (filament wanting or very short), dissimilar, the anterior tending to become sterile. Anterior lip two to four times the width of the posterior. Leaves pinnately lobed. [APOSECOS Benth.]

Anterior anther-sac fertile, brown or yellowish. Style .6–.8 mm. long. Calyx 3–5 mm. long. Pedicels and stems above pubescent with gland-tipped hairs.

Leaves 2-4 cm. long, the blades with one or two partial pairs of segments, the sinuses of which are narrow and reach only one-half to two-thirds the distance to the midrib. Calyx 3-4 mm. long. 13. *F. micrantha*.

Leaves 2-10 cm. long, the blades with usually three pairs of segments, the proximal sinuses of which are usually broad and reach nearly to the midrib. Calyx 4-5 mm. long. 14. *F. radiculoides*.

Anterior anther-sac sterile, yellow or orange-yellow. Style 1-2 mm. long. Calyx 5-9 mm. long.

Anterior anther-sac light-yellow. Corolla 5-7 mm. long. Leaf-blades with shallow crenately-toothed lobes. Distally finely pubescent with glandless hairs. 15. *F. crenatiloba*.

Anterior anther-sac orange-yellow. Corolla 7-21 mm. long. Leaf-blades with deep sharply serrate lobes.

Stems above and pedicels pubescent with few-celled gland-tipped hairs. Blades of lowermost leaves with shallow lobes. Base of petioles very narrowly connate. Calyx-lobes slightly serrate, obviously ciliate with gland-tipped hairs. Style 1-1.3 mm. long. Capsule pubescent with short gland-tipped hairs. 16. *F. chelidonioides*.

Stems above and pedicels hirsute with many-celled dark-jointed hairs. Blades of all leaves pinnatisect nearly to the midrib. Base of petioles obviously connate. Calyx-lobes decidedly serrate, hirsute on the back and margin. Style 1.8-2 mm. long. Capsule pubescent with glandless (or in *pinnatisecta* with interspersed gland-tipped) hairs.

Corolla 15-21 mm. long. Calyx-lobes ovate, acute. Capsule 6 mm. long. Leaves 5-8 cm. long, 3-5 cm. wide. 17. *F. scalaris*.

Corolla 8-10 mm. long. Calyx-lobes lanceolate or narrowly ovate, acuminate. Capsule 4 mm. long. Leaves 3-5.5 cm. long, 2-3 cm. wide. 18. *F. pinnatisecta*.

1. *Fagelia microbefaria* (Kränzl.) Pennell, comb. nov.

Calceolaria microbefaria Kränzl, in Ann. k. k. Naturh. Hofm. Wien 22: 193. 1907. "Kolumbien, Ostkordilleren, Provinz Pamplona, zwischen Urban und Las Vetas in 3300 m ü. d. M. (Linden Nr. 730!)."

Stem 1-2 meters tall, much branched, woody, with grayish-brown bark, the twigs reddish- or yellowish-brown, glutinous and finely pubescent. Leaves 6-8 cm. long, the blades lanceolate, acuminate, serrate to entire, at times slightly revolute, 12-17 mm. wide; each narrowed to a petiole 5-10 mm. long; blades above green, pubescent on the midrib or pulverulent or quite glabrous, beneath glaucous, sparsely puberulent to glabrous, reticulate; somewhat glutinous on upper surface. Corymb bractless, the secondary branches slightly

if at all branched, so that the inflorescence simulates a stalked four-flowered umbel. Peduncle and pedicels somewhat glutinous and pubescent with brown hairs. Calyx 4-6 mm. long, the lobes triangular-ovate, obtusish to acute, entire, puberulent, glutinous. Corolla: posterior lip 6-7 mm. long, 7-9 mm. wide, with broad rounded orifice; anterior lip 12-13 mm. long, 8-10 mm. wide, with rounded orifice opening into two-thirds or more of its length; sac pressed against hood so that corolla appears broader than long; externally finely puberulent, within glandular-pubescent proximally, especially about bases of filaments. Filaments stout, less than 1 mm. long. Anther 2.5 mm. long, brown, the walls thin, the sacs contiguous, opening throughout and eventually through the thin connective. Style 3 mm. long. Capsule 5 mm. long, broadly ovate, acute, puberulent. Seeds .4-.5 mm, long, oblong, obtuse, ridged, red brown.

Thickets, along streams and at edge of forest, also in thicket-islands in Paramo, at altitudes of 2800 to 3300 meters; Temperate zone of western slope of Cordillera Oriental, from Santander to Cundinamarca.

Cundinamarca. Rio Frio, west of Zipaquirá (along stream-banks), Pennell 2570, 2605; Mt. Chuscal, west of Zipaquirá (thicket-island in paramo), Pennell 2584; Sibaté (bushy hillsides southwest of), Pennell 2389.

2. *Fagelia fruticosa* Pennell, sp. nov.

Stem 1-2 meters tall, much branched, woody, with grayish bark, the twigs reddish and glutinous-puberulent or slightly pubescent. Leaves 5-6 cm. long, the blades lanceolate, acuminate, slightly serrulate to entire, at times slightly revolute, 12-13 mm. wide; each narrowed to a petiole 4-7 mm. long; blades above dark-green and puberulent, beneath paler and reticulate, on both surfaces strongly glutinous. Corymb bractless, the secondary branches soon branching so as to simulate an umbel. Peduncle and pedicels glutinous and somewhat pubescent with brown hairs. Calyx 2-3 mm. long, the lobes broadly ovate, acute, entire, puberulent, glutinous. Corolla: posterior lip 6-7 mm. long, 7-8 mm. wide, with broad rounded orifice; the anterior lip 12-13 mm. long, 8-9 mm. wide, with rounded orifice opening into two-thirds or more of its length; sac pressed against hood so that corolla appears broader than long; externally finely puberulent, within pubescent proximally, especially near the filaments. Filaments stout, less than 1 mm. long. An-

thers nearly 2 mm. long, brown, the walls thin, the sacs contiguous, opening throughout and through connective. Style 3 mm. long. Capsule 5 mm. long, broadly pyramidal, acute, glandular-puberulent. Seeds.

Plant more glutinous and drying blacker than *Fagelia microbefaria*.

Type, forest at margin of Paramo de Ruiz, Tolima, altitude 3200–3500 meters, collected in flower December 16, 1917, F. W. Pennell 2998; in Herb. New York Botanical Garden.

Shrub belt about and below paramo, Temperate zone, eastern slope of the Cordillera Central, in Tolima.

3. *Fagelia lehmanniana* (Kränzl.) Pennell, comb. nov.

Calceolaria lehmanniana Kränzl. in Fedde, Rep. Nov. Spec. 1: 100. 1905. "Columbien: Dpto. Cauca; an feuchten Orten an den oberen Gehängen des Vulkan de Sotará und auf dem Paramo de Barbillas in 3000 bis 3300 m ü. d. M. (F. C. Lehmann, no. 6134!);" not *C. lehmannii* (Hieron) Hieron. in Engl. Bot. Jahrb. 20. Beibl. 49: 57. 1894.

At altitudes of 2800 to 3300 meters, Temperate Zone, southern Cordillera Central, from Cauca to Pasto.

Pasto. Puruquai, J. Triana in 1851–7 (Y).

4. *Fagelia crenata* (Lam.) Kuntze.

Calceolaria crenata Lam., Encyc. Meth., Bot. 1: 556. 1785. "Trouvée au Pérou par M. Joseph de Jussieu (v. s. in herb. Juss.)." Jussieu collected mainly in Ecuador.

Fagelia crenata (Lam.) Kuntze, Rev. Gen. 495. 1891.

At an altitude of 3000 meters, Temperate Zone, southern Cordillera Central, from Pasto to Ecuador.

Cauca. Valle de Quintero above Pitaio, R. Palo basin, Central Cordillera, H. Pittier 1425 (U).

Pasto. "Tuquerres et Puruquai," J. Triana in 1851–7. "Judabolsa."

5. *Fagelia saxatilis* (H. B. K.) Kuntze.

Calceolaria saxatilis H. B. K., Nov. Gen. et Sp. 2: 382. 1817. "Crescit locis saxosis montis Chimborazo in summa planitie Sisgun, alt. 1750 hex. [= 3325 meters] . . . [Humboldt & Bonpland]."

Fagelia saxatilis (H. B. K.) Kuntze, Rev. Gen. 460. 1891.

Stem about 1 meter tall, much branched, herbaceous, green or reddish, pubescent with white hairs, densely so above. Leaves 3–4 cm. long, the blades ovate, cordate or truncate at base, obtuse, each narrowed to a petiole 5–10 mm. long; blades above green, finely pubescent, beneath pale and densely pubescent, with some sessile glands; petiole white-lanate. Corymb bracted at base, its secondary branches usually quite simple. Pedicels lanose with glandless white

hairs. Calyx 8–14 mm. long, the lobes ovate, obtuse to acute, obscurely lobed, lanose-pubescent. Corolla: the posterior lip 3–4 mm. long the two lobes united nearly to apex (so strongly hooded, with shallow median orifice); anterior lip 20–25 mm. long, 10–12 mm. wide, with orifice opening about one-third of its length; sac upcurving toward hood, the orifice opening externally; externally glandular-pruinose, within slightly pubescent at base on anterior side. Filaments 2 mm. long. Anthers 2 mm. long, brown, the walls thick, the sacs broadly contiguous, opening throughout and through the thin connective. Style 1.5 mm. long. Capsule 5–6 mm. long, broadly globose-pyramidal, obtuse, thick-walled, puberulent with gland-tipped hairs. Seeds .5 mm. long, oblong, distally acute, finely ridged, brown.

Thickets, along streams and at edge of forest, at altitudes of 2700 to 3300 meters; Temperate zone of eastern slope of Cordillera Central, from Tolima to Ecuador. Collected also above Bogotá, where probably an escape.

Tolima. "Rosalito," near Paramo de Ruiz (along stream in meadow), Pennell 2990. Also recorded by Kränzlin from Paramo de Ruiz, Purdie.

Cundinamarca. Guadalupe, above Bogotá, Bro. Ariste-Joseph A230 (U).

6. *Fagelia bogotensis* Pennell, sp. nov.

Stem probably about 1 meter tall, branched, herbaceous, pubescent with white hairs, distally these gland-tipped. Leaves 4–5 cm. long, the blades triangular ovate, cordate, acuminate, irregularly dentate with acute lobes 3–4 cm. long, 2.5–3 cm. wide; each on a wingless petiole 10–20 mm. long; blades above green, pubescent, beneath lighter green and moderately pubescent, without sessile glands; petiole pubescent, some hairs gland-tipped. Corymb leafy-bracted at base, its secondary branches becoming much branched. Peduncles and pedicels hirsute with gland-tipped hairs. Calyx 10–12 mm. long, the lobes ovate, acuminate, entire, hirsute-pubescent. Corolla: the posterior lip 4 mm. long, the two lobes united nearly to apex (so strongly hooded, with shallow median orifice); anterior lip about 10 mm. long, with orifice opening less than $\frac{1}{2}$ of length; sac upcurving toward hood, the orifice opening externally; externally glandular-pruinose, within somewhat pubescent at base. Filaments 1.5 mm. long. Anthers 2.5 mm. long, brown, the walls thick, the sacs broadly contiguous, opening from proximal end,

eventually to the distal apex. Style 3 mm. long. Capsule 6-8 mm. long, urceolate-pyramidal, acute, thick-walled, pubescent with short gland-tipped hairs. Seeds .3 mm. long, oblong, mucronately acute at each end, ridged, brown

Type, Bogotá, Cundinamarca, alt. 2600 meters, collected in 1851-1857 by J. Triana; in Herb. Columbia University at The New York Botanical Garden.

At an altitude of slightly over 2600 meters, Temperate zone of western slope of Cordillera Oriental, in Cundinamarca.

7. *Fagelia trilobata* (Hemsl.) Rusby.

Calceolaria trilobata Hemsl., Biol. Centr. Am., Bot. 2: 439. 1881-2. "Guatemala, Volcan de Fuego, 7000 to 10,000 feet (Godman & Salvin, 239). Colombia. Hb. Kew. The description was mainly drawn up from Hotton's [= Holton's] Colombian specimen, n. 575." Species an aggregate, and to be typified by I. F. Holton 575. An isotype of this, in Herb. Columbia University at The New York Botanical Garden is labeled "Rio Arzobispo, in montibus juxta Bogotam, legit . . . 23 Oct. 1852." A redescription, from this specimen, is given below.

Fagelia trilobata (Hemsl.) Rusby in Mem. Torr. Bot. Club 6: 93. 1896. As to synonymy only.

Stem probably about 1 meter tall, branched, herbaceous, pubescent with white hairs, distally these gland-tipped. Leaves 15-17 cm. long, the blades triangular, slightly three-lobed, cordate, tapering to an acute tip, irregularly crenate-dentate, with callous-tipped lobules, 9-10 cm. long, 11-12 cm. wide, each on a petiole 6-7 cm. long its wing distally very narrow, proximally expanding to 3-4 cm. wide and connate with that of opposing leaf; above green, pubescent, beneath pale-green and slightly pubescent, more so on the veins, narrow-winged portion of petiole pubescent, some hairs with glandular tips. Corymb leafy-bracted at base, its secondary branches much branched. Peduncles and pedicels hirsute with gland-tipped hairs. Calyx 12 mm. long, the lobes ovate, acuminate, obscurely lobate, hirsute-pubescent. Corolla: the posterior lip 5-6 mm. long, the two lobes not united to apex, so not hooded, with deep, narrow median orifice; anterior lip 10-12 mm. long, with orifice opening much less than one-half of length; sac upcurving toward hood; externally glandular-pruinose, within somewhat pubescent at base. Filaments 2 mm. long, widening distally. Anthers 3.5 mm. long, brown or yellowish, the walls thick; the sacs broadly contiguous, opening throughout, the septum between very thin, and ultimately (?) breaking. Style 4 mm. long. Capsule glandular-puberulent, not seen mature.

Thickets along stream, at an altitude between 2600 and 3000 meters, Temperate zone of western slope of Cordillera Oriental, in Cundinamarca.

8. *Fagelia alata* Pennell, sp. nov.

Stem about 1 meter tall, little branched herbaceous, pubescent with white hairs, distally lanose and with short-stalked glands. Leaves 11–17 cm. long, the blades triangular-ovate, cordate, acuminate, coarsely doubly dentate (dentate with the lobules triangular and dentate), 7–10 cm. long, 6–8 cm. wide; each on a petiole 4–7 cm. long, this broadly winged throughout (in middle 10–18 mm. wide), entire to crenate-dentate, proximally slightly expanding and connate with that of opposing leaf; above green, beneath pale green, on both surfaces slightly pubescent, more so on younger growth. Corymb bractless, its secondary branches repeatedly branched. Peduncles and pedicels pubescent with longer white glandless, and with shorter gland-tipped hairs. Calyx 8–9 mm. long, the lobes lanceolate, acuminate, slightly serrate-dentate or some entire, glandular-puberulent. Corolla: the posterior lip 2–3 mm. long, 5 mm. wide, arched, the two lobes united very nearly to apex (so hooded with slight median aperture); anterior lip 8–9 mm. long, 7 mm. wide, with orifice opening much less than $\frac{1}{2}$ length (not strongly upcurving toward hood); externally minutely glandular-puberulent, within minutely pubescent at base on anterior side, lemon-yellow margin of sac very finely purple-spotted. Filaments .5–.7 mm. long, narrowing distally. Anthers 2 mm. long, yellowish, the walls thick; the sacs narrowly contiguous, opening throughout, the septum between thin and ultimately breaking. Style 1.5–1.8 mm. long. Capsule 3–4 mm. long, urceolate-pyramidal, emarginate, pubescent with short gland-tipped hairs. Seeds .2–.3 mm. long, oblong, distally obtuse, ridged, black-brown.

Type, moist bank in forest, loam soil, western slope of Cordillera Oriental, east of Neiva, Huila, altitude 1800–2300 meters, collected in flower and fruit August 1–8, 1917, Rusby & Pennell 579, in Herb. New York Botanical Garden.

Moist banks in forest at an altitude between 1800 and 2300 meters, Subtropical zone of the western slope of Cordillera Oriental, in Huila.

9. *Fagelia nevadensis* Pennell, sp. nov.

Stem erect, nearly 1 meter tall, branched, pubescent, lanose distally, with long glandless white dark-jointed hairs. Leaves 16 cm. long, the blades ovate, cordate, acuminate, doubly and sharply

dentate, (dentate with lobules irregularly and sharply dentate), 10 cm. long, 8-9 cm. wide; each on a petiole 6 cm. long, uniformly winged throughout (in middle 8-13 mm. wide), entire, proximally slightly expanding and connate with that of opposing leaf; above green, beneath slightly paler, slightly pubescent on both surfaces. Corymb leafy-bracted at base, its secondary branches long, each dividing above a long peduncular portion into six to eight pedicels. Peduncles and pedicels hirsute with glandless white hairs and with short-stalked glands. Calyx 11-12 mm. long, the lobes ovate, acuminate, entire, pubescent. Corolla: the posterior lip about 5 mm. long, 6 mm. wide, arched, the two lobes united to apex (so hooded, truncate without apical aperture); anterior lip 13-14 mm. long, 12-14 mm. wide, with orifice opening much less than one-half length of sac (sac strongly upcurving toward hood); externally glabrous, within pubescent at base on anterior side. Filaments .8 mm. long. Anther straight, 3.5 mm. long, grayish, its walls firm; sacs contiguous, permanently separated by a firm septum, each opening by a slit from the distal apex which does not reach the proximal end. Style 4 mm. long. Capsule 5-7 mm. long, pyramidal, somewhat obtuse, puberulent, with short-stalked glands. Seeds .2-.3 mm. long, irregularly oblong, ridged and transverse-lined, dark-brown.

Type, damp hillside, clearing at Las Nubes, slopes of Sierra Nevada de Santa Marta, Magdalena, collected in flower and fruit December 15, 1898-1901, Herbert H. Smith 1404, in herbarium New York Botanical Garden; isotypes in Gray Herbarium, United States National Museum, and Field Museum of Natural History. Said to be from "4500 feet" [= 1350 meters], such a low elevation for a plant of this genus as to force the suspicion that datum is erroneous. The specimen is more probably from some slope much higher, surely over 2000 meters altitude.

10. *Fagelia tolimensis* Pennell, sp. nov.

Stem lax, ascending, 1 to 2 meters long, branched, reddish, herbaceous, glabrate below, above slightly hirsute with dark-jointed hairs. Leaves 8-10 cm. long; the blades triangular-lanceolate, cordate or truncate, acuminate, irregularly and somewhat doubly dentate (dentate with lobules shallowly triangular and irregularly acutely toothed), 6-7 cm. long, 2.5-3.5 cm. wide; each on a petiole 2-3 cm. long, broadly winged throughout (in middle 12-15 mm. wide), irregularly shallowly crenately dentate, proximally expanding and connate with that of opposing leaf; above dark-green, minutely

pubescent, becoming glabrate, beneath pale-green, permanently pubescent, especially on the veins. Corymb leafy-bracted at base, its secondary branches soon much branched (pedicels long and slender). Peduncles and pedicels hirsute with dark-jointed hairs, these of various lengths. Calyx 8–10 mm. long, the lobes ovate, acuminate, entire, pubescent. Corolla: the posterior lip 3–4 mm. long, 5 mm. wide, arched, the two lobes united to apex (so hooded, without median aperture); anterior lip 12–14 mm. long, 10 mm. wide, with orifice opening about one-half length (sac strongly up-curving toward hood); externally slightly pubescent to glabrate, within glabrous throughout. Filaments 1.2 mm. long. Anthers horseshoe-shaped, brown; each sac 2 mm. long, contiguous, splitting its entire length, septum between sacs thin, but apparently not rupturing. Style 5 mm. long, proximally pubescent. Capsule pubescent with white glandless hairs; not seen mature.

Type, moist mossy loam, margin of forest, "Rosalito" (east of Paramo de Ruiz), Tolima, altitude 2800–3100 meters, collected in flower December 15–17, 1917, F. W. Pennell 2979; in Herb. New York Botanical Garden.

Nearest to *Fagelia purpurascens* (Sodirol) Pennell, comb. nov., of Ecuador, but appears distinct in having leaves more sharply cut, stem less pubescent, pedicels more slender and sepals shorter.

Moist soil, edge of forest, at an altitude between 2800 and 3100 meters, Temperate zone of eastern slope of Cordillera Central, in Tolima.

11. *Fagelia perfoliata* (L. f.) Kuntze.

Calceolaria perfoliata L. f., Suppl. 86. 1781. "Habitat in Nova Granada. Mutis." Type probably from Bogotá.

Fagelia perfoliata (L. f.) Kuntze, Rev. Gen. 460. 1891.

Stems lax, ascending, 1–2 meters long, somewhat branched, reddish-brown, pubescent throughout, above densely so, with hairs not or slightly dark-jointed. Leaves 8–13 cm. long, the blades triangular-lanceolate to ovate, cordate to truncate, acuminate, irregularly and somewhat doubly dentate (dentate with lobules shallowly triangular and shallowly dentate), 5–8 cm. long, 3.5–5.5 cm. wide; each on a petiole 3–5 cm. long, broadly winged throughout (in middle 15–20 mm. wide), slightly crenate-dentate to entire, proximally expanding and connate with that of opposing leaf; above green, beneath whitish-green, pubescent on both surfaces, densely canescent beneath. Corymb leafy-bracted at base, its secondary branches soon much branched (pedicels long and slender). Pe-

duncles and pedicels villous, with spreading dark-jointed hairs, these mostly long. Calyx 9–11 mm. long, the lobes ovate, acuminate, entire, pubescent. Corolla: the posterior lip 4–5 mm. long, 5–6 mm. wide, arched, the two lobes united to apex (so hooded without median aperture); anterior lip 13–14 mm. long, 7–8 mm. wide, with orifice opening about one-half length (sac strongly upcurving toward hood), externally slightly pubescent to glabrate, within glabrous throughout. Filaments about 1 mm. long. Anthers horse-shoe shaped, brown, each sac 1.8 mm. long, contiguous, splitting from proximal end its entire length, septum between sacs thin and rupturing. Style 5 mm. long, proximally pubescent. Capsule 5 mm. long, urceolate-pyramidal, acutish, pubescent with white glandless hairs. Seeds .5 mm. long, lanceolate, distally acuminate, ridged, and transverse-lined, brown.

Moist bushy slopes, along streams in shrub-zone, at altitudes of 2700 to 3000 meters, Temperate zone of western slope of Cordillera Oriental, in Cundinamarca.

Cundinamarca. Rio San Cristobal, near Bogotá (bushy mountain-slope, alt. 2800–3000 m.), Pennell 2380; Chipaque (moist road-bank above, alt. 2800–2900 m.), Pennell 1317; Sibaté (bushy slopes near, alt. 2700–3000 m.), Pennell 2485; Bogotá (alt. 2700 m.), J. Triana (U, Y).

12. *Fagelia ovata* (Smith) Kuntz.

Calceolaria ovata Smith, Ic. Ined. 1:3 pl. 3. 1789. "Ex Peru semina setulit Dombey."

Fagelia ovata (Smith) Kuntz, Rev. Gen. 460. 1891.

Stem erect or ascending, 1–4 dm. tall, branched, pubescent with white gland-tipped hairs. Leaves 2.5–3.5 cm. long, the blades ovate, narrowed to nearly truncate at base, acute, obscurely simply serrate with shallow teeth, 2.3–3 cm. long, 1–1.5 cm. wide; each on a petiole .2–.5 cm. long, not winged, lanose with gland-tipped hairs; green, beneath slightly paler, pubescent on both surfaces. Inflorescence apparently axillary, actually at each node two pedicels occur, at right angles to which are two leaves from the axil of one of which usually develops the branch which indefinitely repeats this manner of branching. Pedicels pubescent with gland-tipped hairs. Calyx 3 mm. long, the lobes ovate, acutish, entire, pubescent. Corolla: the posterior lip 3–4 mm. long, 4–5 mm. wide, arched, the two lobes united throughout, distally attenuate to a slightly notched apex (so hooded); anterior lip 5 mm. long, 5 mm. wide, widest at base. with orifice opening much less than one-half length of sac

(sac, upcurved toward hood, its anterior surface incurved forming a broad pouch into which anthers shed pollen and into which the stigma grows, apparently ensuring self-pollination); externally glabrous, within with a few hairs about base. Filaments 1.5 mm. long. Anthers .6 mm. long, elliptic or hemispheric, yellow, the walls thin; sacs contiguous by a broad contact, opening throughout. Style 1.2 mm. long. Capsule 5-6 mm. long, narrowly pyramidal, obtusish, thin-walled, sparsely puberulent with short-stalked glands. Seeds .1-.2 mm. long, oval, obtuse, ridged and transverse-lined, brown.

Type, moist roadside below Chipaque, Cundinamarca, altitude 1800-2200 m., collected in flower August 23, 1917, F. W. Pennell 1327; in Herb. New York Botanical Garden.

Moist shaded banks, at altitudes of 1300 to 2200 meters, Subtropical zone of eastern slope of Cordillera Oriental, in Cundinamarca.

Cundinamarca. Chipaque (moist roadside below, alt. 1800-2200 m.), Pennell 1327; Quetame to Monte Redondo (moist cliff, along stream in woodland, alt. 1300 m.), Pennell 1352, (moist bank, alt. 1400-1500 m.), Pennell 1854.

13. *Fagelia micrantha* Pennell, sp. nov.

Stem spreading and laxly ascending, 2-3 dm. long branched, sparsely pubescent below with short few-celled gland-tipped hairs. Leaves 2-4 cm. long, the blades acute or obtusish at apex, irregularly pinnately lobed with 1-2 pairs of segments, the incisions usually reaching $\frac{1}{2}$ to $\frac{2}{3}$ the distance to the midrib, the lobules and main portion of the blade irregularly dentate, 1.5-3 cm. long, 1.5-2.5 cm. wide; each on a petiole .5-1 cm. long, slightly winged, proximally clasping stem and slightly connate with that of opposing leaf; above deep-green, with sparse scattered pubescence soon becoming glabrous, beneath pale-green and nearly glabrous. Corymb leafy-bracted at base (the two primary flowers developed), the secondary branches scarcely or not longer than the primary pedicels, usually once dividing, and bracted with reduced leaves. Peduncles and pedicels pubescent with short gland-tipped hairs. Calyx 3-4 mm. long, the lobes oblong-ovate, obtuse, slightly serrate, pubescent proximally. Corolla: the posterior lip about 2 mm long and 2 mm. wide, arched, the two lobes united and slightly hooded, free toward apex (leaving a narrow arched aperture into hood); anterior lip 5-6 mm. long, 4-5 mm. wide, with narrow base, hooded almost

entire length (sac strongly upcurving against hood): externally glabrous or minutely puberulent at base, within glabrous. Filaments none. Anther with two sacs separated on two arms of the connective, both sacs fertile; opening throughout, the anterior projecting into orifice, smaller; posterior arm (with sac) 1.5 mm. long, anterior arm (with sac) 1 mm. long. Style 6-.8 mm. long. Capsule glabrous, not seen mature.

Type, along streamlet, edge of forest, "Rosalito" (between Murillo and Paramo de Ruiz), Tolima, altitude 2800-3100 meters, collected in flower December 17, 1917, F. W. Pennell 3145; in Herb. New York Botanical Garden. Growing with 3119, *F. crenatiloba*.

Along streamlets, edge of forest, at an altitude between 2800 and 3100 meters, Temperate zone of eastern slope of Cordillera Central, in Tolima.

14. *Fagelia radiculoides* Pennell, sp. nov.

Stem spreading and laxly ascending, 1-15 dm. long, branched, glabrate, above pubescent with spreading gland-tipped hairs. Leaves 2-10 cm. long, the blades acute to acuminate at apex, pinnately lobed with usually three pairs of lanceolate segments, the incisions extending nearly to the midrib, the lobules and terminal segment irregularly serrate-dentate, 1.5-6 cm. long, 1.5-6.5 cm. wide; each on a petiole .5-4 cm. long, narrowly winged, proximally slightly expanding and connate with that of opposing leaf; above deep-green, with scattered hairs or glabrous, beneath glaucous, glabrous or pubescent on the midrib. Corymb leafy-bracted at base (the two primary flowers developed), the secondary branches long and repeatedly dividing, bracted throughout. Peduncles and pedicels pubescent with gland-tipped hairs. Calyx 4-5 mm. long, the lobes ovate, acute to obtusish, obscurely slightly serrate, pubescent proximally and on margin with gland-tipped hairs. Corolla: the posterior lip 1.5-2 mm. long, 2 mm. wide, arched, the two lobes united and slightly hooded, free toward apex (leaving a narrow arched aperture into hood); anterior lip 6-7 mm. long, 4-5 mm. wide, narrowed at base, hooded almost entire length (sac strongly upcurving against hood); externally and internally glabrous. Filaments none. Anther with two sacs separated on two arms of the connective, both sacs fertile, opening throughout, of about equal size, each arm (with sac) about 1 mm. long. Style .7-.8 mm. long. Capsule 3-4 mm. long, broadly globose-pyramidal, rounded and slightly notched, somewhat pubescent with gland-tipped hairs.

Seeds .5-.6 mm. long, oblong, obtuse, ridged (with rounded ridges) dark-brown.

Type, moist rocky cañon, Rio San Francisco, above Bogotá, Cundinamarca, altitude 2700-2800 meters, collected in flower and fruit September 13, 1917, F. W. Pennell 1942; in Herb. New York Botanical Garden.

Moist or wet soil, springheads, swales and cliffs, partially shaded or open, at altitudes of 2600 to 3200 meters, occasionally descending to 1500 meters, Temperate zone, ascending to Paramo, where dwarfed, and to Subtropical zone, where more rank; on both slopes of the Cordillera Oriental, in Cundinamarca.

Cundinamarca. Zipaquirá (springhead in meadow, alt. 2650 m.), Pennell 2534; Mt. Chuscal, west of Zipaquirá, (swale on paramo, alt. 3100-3200 m.), [only 1-2 dm. tall; leaves in some plants more pubescent], Pennell 2602; Bogotá (moist rocky cañon on Rio San Francisco above, alt. 2700-2800 m.), Pennell 1942, (moist bank, base of mount, alt. 2700-2800 m.), Pennell 2293; Sibaté (wet road-bank, alt. 2600-2800 m.), Pennell 2386; Ubagué (moist loam in shrub-zone above, alt. 2700-3000 m.), Pennell 1898; Monte Redondo to Quetame (wet bank, alt. 1400-1500 m.) [plant especially rank], Pennell 1855.

15. *Fagelia crenatiloba* Pennell, sp. nov.

Stem ascending, 3-6 dm. long, little branched, glabrous or nearly so, above pubescent with white several-celled glandless hairs. Leaves 5-7 cm. long, the blades obtuse or acutish at apex, pinnately lobed with 2-3 pairs of segments, the incisions rarely extending over $\frac{1}{2}$ - $\frac{2}{3}$ the distance to the midrib, the lobules and main portion of blade crenately dentate, 3.5-5 cm. long, 3-4 cm. wide; each on a petiole 1.5-2 cm. long, slightly margined, glabrous or nearly so, proximally somewhat expanding and connate with that of opposing leaf; above green and with scattered pubescence, beneath pale-green and the midrib and principal veins pubescent. Corymb leafy-bracted at base (the two primary flowers developed), its secondary branches longer, once or twice dividing and bracted throughout with reduced leaves. Peduncles and pedicels finely pubescent with several-celled glandless hairs. Calyx 5-6 mm. long, the lobes ovate, obtuse or acutish, slightly serrate, slightly pubescent, especially proximally. Corolla: the posterior lip 1-2 mm. long, 2-2.5 mm. wide, arched, the two lobes united and slightly hooded, free toward apex (leaving a narrow or triangular slit-like aperture into hood);

anterior lip 5–7 mm. long, 4–5 mm. wide, narrowed at base, hooded almost entire length (sac strongly upcurving against hood); externally glabrous or finely puberulent proximally, within glabrous. Filament none or very short. Anther with the two sacs separated on two arms of the connective, each (including sac) about 1.5 mm. long; posterior sac .6–.7 mm. long, whitish, opening throughout, fertile, concealed within hood; anterior sac shorter, projecting into orifice, partially or wholly sterile. Style 1 mm. long. Capsule nearly globose, finely pubescent with glandless hairs; not seen mature.

Type, along streamlet, edge of forest, "Rosalito," (between Murillo and Paramo de Ruiz), Tolima, altitude 2800–3100 meters, collected in flower December 17, 1917, F. W. Pennell 3119; in Herb. New York Botanical Garden.

Along streamlets, edge of forest, at an altitude between 2800 and 3100 meters, Temperate zone of eastern slope of Cordillera Central, in Tolima.

16. *Fagelia chelidonioides* (H. B. K.) Kuntze.

Calceolaria chelidonioides H. B. K., Nov. Gen. et Sp., 2: 378. 1818. "Crescit in radicibus montis Javirac prope Quito, alt. 1500 hex. [= ca. 2850 m.] [Humboldt & Bonpland]."

Fagelia chelidonioides (H. B. K.) Kuntze, Rev. Gen. 2: 459. 1891.

Fagelia diversifolia Pennell, in Addisonia 4: 73, pl. 153. "Type . . . collected on a moist bank at Chipaque, Department of Cundinamarca, Colombia, at an altitude of about 8700 feet, August 23, 1917, my number 1320, and is preserved in the herbarium of the New York Botanical Garden." Specimens seen later appear to unite this with the plant from Ecuador.

Stem erect or ascending, 3–9 dm. tall, little branched, sparsely pubescent, more so about nodes, with few-celled gland-tipped hairs. Leaves 4–15 cm. long, the blades acute to acuminate at apex, the lower ovate and shallowly pinnately lobed, irregularly serrate-dentate, the upper pinnately lobed nearly to the midrib with two or three pairs of oval or ovate, irregularly doubly serrate-dentate segments, (the odd terminal segment largest), 3–10 cm. long, 2.5–7.5 cm. wide, each on a petiole 1–5 cm. long, slightly margined, glandular pubescent, proximally slightly expanding and clasping the stem, usually slightly connate with that of opposing leaf; green above, pale green beneath, with scattered pubescence on both surfaces. Corymb leafy-bracted at base (the two primary flowers developed), its secondary branches elongated, several times dividing and bracted throughout with reduced leaves. Peduncles and pedicels finely pubescent with few-celled gland-tipped hairs. Calyx 7–8 mm. long, the lobes ovate, acuminate, slightly serrate (the

few serratures not callous-tipped), slightly pubescent on the back, and conspicuously ciliate with gland-tipped hairs. Corolla: the posterior lip about 3 mm. long, 3-4 mm. wide, arched, the two lobes united and hooded, but not to apex (leaving a narrow slit like aperture into hood), anterior lip 10-15 mm. long, 11-13 mm. wide, narrowed at base, hooded almost entire length (sac strongly up-curving against hood); externally glabrous or puberulent on posterior lip, within pubescent about base and within posterior lip. Filament none. Anther with the two sacs separated on two arms of the connective, each about 1.5-1.8 mm. long; posterior sac 1.2 mm. long, yellowish, opening throughout, fertile, concealed within hood; anterior sac short, orange-yellow, sterile, projecting into the orifice, the club-like dark connective arm serving as a lever against which entering insect pushes, thus forcing the fertile sac out through the slit like aperture of the hood and against back of insect. Style 1.1-1.3 mm. long. Capsule 8 mm. long, globose-pyramidal, obtuse, pubescent with short gland-tipped hairs. Seeds .6-.7 mm. long, oblong, obtuse, ridged (with high rounded ridges), brown.

Moist soil, roadside ditches and banks, frequently cultivated and possibly introduced from Ecuador, at altitudes of 2000 to 2700 meters, Subtropical zone of eastern slope of Cordillera Oriental, in Cundinamarca; also obviously from cultivation at Bogotá and at "Balsillas", east of Neiva in Huila; also from the Subtropical zone of the Cordillera Occidental, in Valle. In Ecuador.

Cundinamarca. Chipaque (moist bank, alt. 2600-2700 m.), Pennell 1320; Ubagué (moist soil, alt. 2000-2500 m.), Pennell 1877; [Zipaquirá (moist ditch on hill—alt. 2900 m.), evidently escaped from garden, Pennell 2567].

[Huila. "Balsillas," on Rio Balsillas (cult. in garden, alt. 2000-2100 m.), Rusby & Pennell 692.]

Cauca. Cuestá de Tocotá, road from Buenaventura to Cali, western Cordillera; alt. 1500-1900 m., H. Pittier 698 (U).

17. *Fagelia scalaris* Pennell, sp. nov.

Stem erect or ascending, about 1 meter tall, little branched, pubescent to hirsute above with many-celled dark-jointed not or scarcely gland-tipped hairs. Leaves 5-8 cm. long; the blades acuminate at apex, pinnatisect (cut nearly to midrib) with 2 or 3 pairs of lanceolate-ovate, irregularly serrate-dentate segments (the odd terminal segment largest), 4-6 cm. long, 3-5 cm. wide; each on a petiole 1-2 cm. long, very narrowly winged, hirsute, proximally

slightly expanding and connate with that of opposing leaf; green, beneath paler, with scattered pubescence on both surfaces. Corymb leafy-bracted at base (the primary flowers sometimes not developed), its secondary branches (one or both developed) long, once or twice dividing and bracted throughout with reduced leaves. Peduncles and pedicels hirsute with yellowish-white dark-jointed hairs. Calyx 6 mm. long, the lobes ovate, acute, serrate (with shallow callous-tipped serratures), densely hirsute. Corolla: the posterior lip 2-3 mm. long, 4 mm. wide, arched, the two lobes united and hooded, but not to apex (leaving a slit-like aperture into hood), anterior lip 15-21 mm. long, 14-18 mm. wide, narrowed at base, with narrow orifice, hooded almost entire length (sac strongly upcurving against hood); externally pubescent with short hairs on posterior lip, with longer hairs on base of anterior lip, within pubescent at base. Filaments very short or not developed. Anthers straight, 4 mm. long, the two sacs separated on two arms of the connective; posterior sac 1.5 mm. long, yellowish, opening throughout, fertile, concealed within hood; anterior sac short, orange-yellow, sterile, projecting into the orifice, the club-like dark connective-arm serving as a lever against which entering insect pushes, thus forcing the fertile sac out through the slit-like aperture of the hood and against back of insect. Style 2 mm. long. Capsule 6 mm. long, globose pyramidal, obtuse, pubescent with glandless hairs. Seeds .6-.7 mm. long, oblong, obtuse, ridge-angled, brown.

Type, swale, "Balsillas," on Rio Balsillas, altitude 2000-2100 meters, collected in flower and fruit August 3, 1917, Rusby & Pennell 710; in Herb. New York Botanical Garden.

Swales, at an altitude of 2000 to 2100 meters, Subtropical zone of eastern slope of Cordillera Oriental, in Huila.

18. *Fagelia pinnatisecta* Pennell, sp. nov.

Stem ascending, 2-6 dm. tall, little branched, pubescent above with many-celled dark-jointed not or scarcely gland-tipped hairs. Leaves 3-5.5 cm. long; the blades acuminate at apex, pinnatisect (cut nearly to midrib) with three pairs of lanceolate, irregularly serrate-dentate segments, (the odd terminal segment largest) 2-3.5 cm. long, 2-3 cm. wide; each on a petiole 1-2 cm. long, narrowly winged, somewhat hirsute, proximally slightly expanding and connate with that of opposing leaf; green and pubescent above, beneath pale, and hirsute pubescent on the main veins, sparsely so over surface. Corymb leafy-bracted at base (the primary flowers not

developed), its secondary branches long, once or twice dividing and leafy-bracted throughout with reduced leaves. Peduncles and pedicels hirsute with yellowish-white dark-jointed hairs. Calyx 7-9 mm. long, the lobes lanceolate or narrowly ovate, acuminate, serrate (with not or scarcely callous-tipped serratures), hirsute, especially proximally. Corolla: the posterior lip 2-3 mm. long, 2-3 mm. wide, arched, the two lobes united and hooded, but not to apex (leaving a narrow aperture into hood); anterior lip 8-10 mm. long, 6-7 mm. wide, narrowed at base, hooded over $\frac{3}{4}$ length (sac strongly upcurving against hood); externally and within slightly pubescent about base. Filaments very short or none. Anther with the two sacs separated on two arms of the connective, each about 1.6-1.8 mm. long; posterior sac 1.2 mm. long, yellowish, opening throughout, fertile, concealed within hood; anterior sac short, orange-yellow, sterile, projecting into the orifice, the club-like dark connective-arm serving as a lever as in *F. scalaris*. Style nearly 2 mm. long. Capsule 4 mm. long, broad-globose, rounded, pubescent with glandless and some gland-tipped hairs. Seeds 6-7 mm. long, oblong, obtusish, ridge-angled, brown.

Type, swale, "Balsillas," on Rio Balsillas, altitude 2000-2100 meters, collected in flower and fruit August 3, 1917, Rusby & Pennell 721, in Herb. New York Botanical Garden. From the same swale as 710, *F. scalaris*.

Swales, at an altitude of 2000 to 2100 meters, Subtropical zone of eastern slope of Cordillera Oriental, in Huila.

21. *RUSSELLIA* Jacquin.

Russelia Jacq., Enum. Pl. Carib. 25. 1760.

Type species, *R. sarmentosa* Jacq., of Cuba.

1. *Russelia colombiana* Pennell, sp. nov.

Herb, or shrubby below, diffuse, reaching 5 feet long. Stem 6-angled below, sharply 4-angled above, glabrous or with sparse pubescence. Leaves in threes, the upper opposite, ovate, 5 cm. long, 3 cm. wide, truncate at base, strongly acuminate, sharply serrate-dentate with ascending teeth (bracts lance-ovate, coarsely toothed), glabrous nearly from the first, green, with brown wax dots on upper surface. Inflorescence much elongated, of axillary cymes. Cymes hirtellous, 5-15-flowered. Calyx 4 mm. long, with brown wax dots, its lobes narrowly ovate with caudate pubescent tips nearly equaling the length of the body, slightly pubescent. Corolla red, 10-11 mm. long, its lobes 1.5 mm. long, the posterior united $\frac{1}{2}$ - $\frac{2}{3}$ their length; externally glabrous, within on anterior side pubes-

cent with yellow hairs. Stamens and pistil glabrous throughout. Capsule brown, globose-ovoid, 4.5–5 mm. long, with a slender beak 1–1.5 mm. long.

Related to *R. sarmentosa* Jacq. of Cuba, which differs in the stem being 4-angled, its leaves smaller, with rounded teeth and obtuse at apex, its sepals with shorter caudate tips, its corollas slightly larger, 12–14 mm. long, and its capsules smaller, excluding the beak, only 4 mm. long.

Type, in mountain forest, on the Agua Dulce road, between Santa Marta and the Sierra Nevada, altitude 450 meters [= 1500 feet], collected in flower and fruit November 22, 1898, Herbert H. Smith 1361; in Herb. New York Botanical Garden; isotypes in United States National Herbarium, Gray Herbarium and Field Museum of Natural History.

Forest, at an altitude of 450 meters, Tropical zone on lower slopes of Sierra Nevada de Santa Marta in Magdalena.

22. ANGELONIA Humboldt and Bonpland.

Angelonia Humb. & Bonpl., Pl. Aequin. 2: 92. 1809.

Type species, *A. salicariaefolia* H. & B.

1. *Angelonia salicariaefolia* Humb. & Bonpl.

A. salicariaefolia Humb. & Bonpl., Pl. Aequin. 2: 92. pl. 108. 1809. "Habitat in America meridionali ad Caracas." "Croît sur les collines arides de gneiss, qui avoisinent la ville de Caracas, à une hauteur de cinq ou six cents toises [ca. 1000–1200 m.] ou-dessus du niveau de l'océan." Specimen from Caracas, Otto Kuntze 1407, seen in Herb. New York Botanical Garden.

Gravelly slopes, rather moist, along the lower western slopes of the Cordillera Oriental, and the similar eastern slopes of the Cordillera Central, doubtless continuously encircling the upper Magdalena Valley; in the Cauca valley; extending eastward along the northern lower slopes of the Venezuelan Andes; at altitudes of 450–1400 meters. Tropical zone.⁴

Cundinamarca. Anapoima, J. Triana (Y); Fusagasugá, I. F. Holton 577 (Y); Fusagasugá to Pandi, Pennell 2714 (Y); Icononzo, Pennell 2761 (Y).

Tolima. San Lorenzo, (first foothill of Cordillera Central, west of), Pennell 3517 (Y).

⁴ *Angelonia angustifolia* Benth.

Specimens collected from plants cultivated at "Medellin," on the bank of the Rio Sinu, Bolívar, Pennell 4141 (Y) appear to be this commonly cultivated species of Mexico. The two plants are readily distinguished:

Herbage densely glandular-pubescent. Leaves lanceolate., clasping at base.

1. *A. salicariaefolia*.

Herbage glabrous or sparsely glandular-pubescent. Leaves linear-lanceolate, narrowed at base.

2. *A. angustifolia*.

Huila. Neiva (open slope of first foothill of Cordillera Oriental, east of), Rusby & Pennell 1082 (Y); Quebrada de Angeles, above Natagaima, Rusby & Pennell 284 (Y).

Valle. Cali, H. Pittier 632 (V).

23. LINARIA Miller.

Linaria Mill., Gard. Dict. ed. IV. 1754.

Type species, *Antirrhinum linaria* L., Sp. Pl. 616. 1753, of Europe.

1. *Linaria texana* Scheele.

Linaria texana Scheele in *Linnaea* 21: 761. 1848. "Zwischen Houston und Austin [Texas] häufig: Römer." Type not seen nor verified, but description evidently of plant here characterized.

Meadow-land, on the Sabana of Bogotá, at an altitude of 2600 to 2650 meters, certainly introduced. Widespread through western temperate North America, and collected extensively in Andine and Temperate South America, probably always as a weed.

Cundinamarca. Sibaté (meadow on sabana, alt.), Pennell 2469; Hacienda de Tequendama, I. F. Holton (Y).

Corrections to "Scrophulariaceae of the Southeastern United States" in Proceedings of the Academy of Natural Sciences of Philadelphia 1919: 224-291. 1920.

- p. 228, last line. For "*Ranapalus*" read "*Macuillamia*."
- p. 231, l. 19. Delete "lanate."
- p. 238, l. 31. Delete "stoloniferous." The plants have slender root-stocks, not stolons.
- p. 242. For entry under genus "8. *Ranapalus* Kellogg," substitute: "8. *Macuillamia* Rafinesque.
Macuillamia Raf. [Neogenyton 2. 1825, generic description only] Autik. Bot. 44. 1840.
Type species, *Monniera rotundifolia* Michx., of Illinois.
- 1. *Macuillamia rotundifolia* (Michx.) Raf.
Monniera rotundifolia Michx.,"
- p. 248, l. 8. Before the word "type" read:
Micranthemum orbiculatum Michx., Fl. Bor. Amer. 1: 10. pl. 2. 1803. "Hab. in udis opacisque sylvarum Carolinae et Georgiae."
- p. 250, l. 9. Under "1. *Verbascum blattaria* L.," insert:
"Verbascum claytoni Michx., Fl. Bor. Amer. 1: 148. 1803. 'Hab. in Carolina [A. Michaux].' Evidently a form of the introduced species, *V. blattaria*."
- p. 254, l. 29. For "Texas" read "Louisiana." *Penstemon australis* is replaced west of the Mississippi River by *P. pauciflorus* Buckl.
- p. 255, l. 18. Delete "and west to Oklahoma." Specimens from west of the Mississippi River belong to another species.
- p. 288, l. 1. Delete "Seeds."
- p. 290, l. 29. For "straw-colored" read "brown to straw-colored," as the supposed contrast in color of capsule cannot be maintained.

TWO NEW CYPRINOID FISHES FROM FORMOSA.

BY MASAMITSU OSHIMA.

By courtesy of Mr. Moichiro Maki, of Taihoku Normal School, the author was able to examine the collections of Formosan fresh-water fishes made by his students during the summer of the year 1919. Among them two species of *Leuciscus* were found which are apparently new to science. Unfortunately, there are no records with regard to their type localities. It is certain, however, that they were obtained in the mountain streams of central Formosa, because other species preserved in the same bottle, that is, *Salmo formosanus* and *Liobagrus formosanus*, are not found from in other places than the tributaries of the Taiko and Taito Rivers.

Leuciscus schisturus new species. Fig. 1.

Head 4.20 in length; depth 4.65; D. III,7; A. III,8; P. 17; V. 9; scales 74 in lateral line; 14 scales between origin of dorsal and lateral line, 16 between the latter and middle of belly; 9 scales between

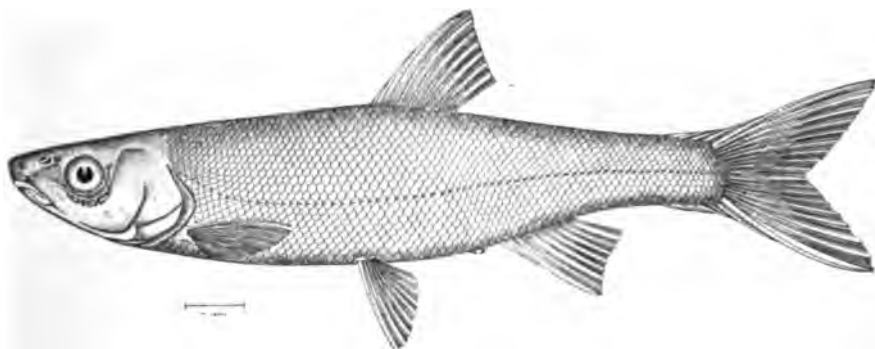


Fig. 1.—*Leuciscus schisturus* new species.

lateral line and the root of ventral; width of head 2 in its length; snout 3 in head; eye 5; interorbital space 3; pectoral 1.50; ventral 1.81; pharyngeal teeth 4, 2-2, 5; gill-rakers 4+8. Body elongate, compressed posteriorly; head elongate, triangular, upper profile nearly straight; snout rather long, pointed, edge of its skin slightly

covering the upper lip; interorbital space and top of head more or less convex; eye small, anterior and superior, 1.46 in snout; mouth subinferior, not very oblique, maxillary reaching posterior border of nostril; lips thin, the lower discontinuous, distinct at the angle of mouth only; anterior margin of lower jaw trenchant; pharyngeal teeth hooked, with no grinding surface; nostrils close together, on the supra-lateral part of snout; gill-openings rather large; gill-rakers rather short and pointed. Origin of dorsal midway between tip of snout and base of caudal, the first branched ray the longest, reaching beyond the others to origin of anal when depressed, its outer margin nearly straight; pectoral five-eighths the distance to ventrals; origin of ventral in advance of that of dorsal, inserted nearer origin of anal than that of pectoral; anal inserted a little nearer to tip of pectoral than base of caudal, the first branched ray the highest, scarcely reaching beyond the others when depressed, the base of the fin 1.50 in its height, outer border slightly concave; caudal peduncle long, its depth 2.50 in head; caudal fin deeply emarginate, lobes sharply pointed. Scales cycloid, imbricated, of rather even size; no pectoral flap; ventral with a slender scaly flap; lateral line continuous, more or less decurved anteriorly, running along the middle of tail. Color in alcohol uniformly grayish brown above, paler below; all the fins whitish. Total length 145 mm.

Habitat: Central Formosa (type-locality unknown).

(*Schisturus*, split-tail; with reference to the well-developed rudimentary caudal rays.)

Leuciscus medius new species.

Head 3.83 in length; depth 4.55; D. III,7; A. III,7; P. 15; V. 8; scales 76 in lateral line; 19 scales between the origin of dorsal and lateral line, 17 between the latter and middle of belly; 11 scales between lateral line and the root of ventral; width of head 2 in its length; snout 3 in head; eye 4.33; interorbital space 3; pectoral 1.71; ventral 1.81; pharyngeal teeth 4,2-2,5; gill-rakers 2+7. Body elongate, compressed; head elongate, pointed, sides flattened, upper profile nearly straight; snout rather pointed, slightly produced; eye moderate, anterior 1.50 in snout; mouth terminal, slightly oblique, maxillary reaching posterior border of nostril; lips thin, not dilated; lower lips discontinuous; anterior margin of lower jaw trenchant; pharyngeal teeth hooked, with no grinding surfaces, nostrils close together, in front of eye above; inter-

orbital space and top of head very slightly convex; gill-openings moderate; gill-rakers rather short and pointed. Origin of dorsal nearer base of caudal than tip of snout, rather high, the first branched ray the longest, reaching far beyond the origin of anal when depressed, its outer margin nearly straight; anal inserted nearer tip of pectoral than base of caudal, the first branched ray the highest, not reaching beyond the others when depressed, the base of the fin 1.42 in its height, its outer margin straight; pectoral two-thirds the distance to ventrals; ventrals inserted nearer origin of anal than that of pectoral, in advance of origin of dorsal; caudal peduncle

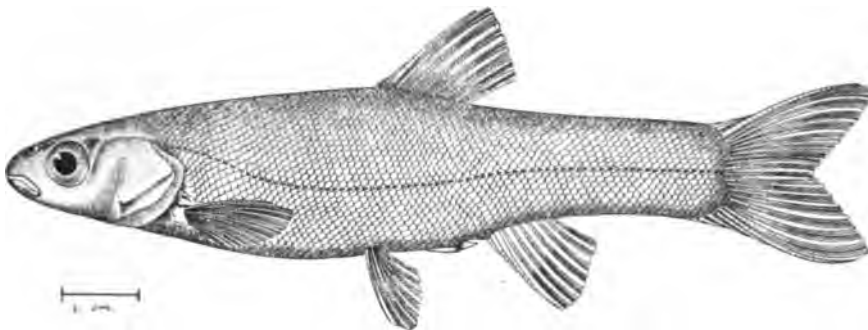


Fig. 2.—*Leuciscus medius* new species.

compressed, its depth 2 in head; caudal fin deeply forked, the lobes obtusely pointed. Scales cycloid, moderately small, of rather even size; no pectoral flap; ventral with a small fleshy flap; lateral line continuous, slightly decurved, running along the middle of the tail. Color in alcohol grayish brown above, paler below; all the fins whitish. Total length, 110 mm.

Habitat: Central Formosa (type-locality unknown).

The present species distinctly differs from the former in having 19 scales between origin of dorsal and lateral line.

(*Medius*, central, the species having been obtained in central Formosa.)

MOLLUSKS FROM LAKE CHAPALA, STATE OF JALISCO AND VICINITY.

BY HENRY A. PILSBRY.

Professor Francisco Contreras, in the course of his studies of the natural resources of Mexico, has made a small collection of the shells of Lake Chapala. The occurrence of peculiar species of *Planorbis*, *Physa*, and *Anodontites* probably indicates that there is a considerable endemic element in the mollusk fauna of this Mexican lake.

In treating of the *Planorbes* and *Physas* of Lake Patzcuaro¹, the writer called attention to the more enlarged last whorl of the shell, compared with the most closely related species found in other Mexican localities. It was conjectured that larger lung capacity might be advantageous to air-breathing snails of this deep lake. The same peculiarity is seen in *Planorbis contrerasi* and *Physa solidissima* of Lake Chapala; but while the shells of Lake Patzcuaro are thin and light, those of Chapala are remarkably solid, perhaps an adaptation to wave-beaten shores.

***Polygyra ventrosula* (Pfr.).**

Chapala. Diameter about 10 mm. Also similar smaller shells, diam. 7.3 mm., which are referable to the variety *hindsii* (Pfr.). Whether these sizes occur in the same colony, or are connected by intermediate sizes, should be noted.

***Polygyra matermontana jaliscoensis* Pils.**

Chapala. This form was described from Guadalajara.

***Drymaeus hegewischi* (Pfr.).**

Chapala.

***Planorbis tenuis chapalensis* new subspecies. Fig. 1.**

The shell is very strong and solid with narrow, deeply sunken spire on the left side. The aperture is piriform, the penult whorl intruding but little.

Greatest diam. 16, alt. at aperture 9.3 mm.

¹ These PROCEEDINGS for 1891, p. 324.

Laguna de Chapala, State of Jalisco, collected by Prof. Francisco Contreras, March 1, 1920. Type No. 46,194.



Fig. 1.—*Planorbis tenuis chapalensis*. Enlarged.

Planorbis contrerasi new species, Fig. 2.

The shell is solid; last whorl compressed on the right side, bluntly angular, with funnel- or vortex-shaped umbilicus; left side angular, with rather wide bowl-shaped concavity. *Surface closely striate spirally within both concavities*, seemingly with weak traces of spiral lines over the peripheral part, though the specimens are all so wave-worn that the external sculpture cannot be seen except within the aperture. The aperture is narrow, angular at the ends.

Greatest diameter 14.3, alt. at aperture 10.2 mm.; fully 4 whorls.



Fig. 2.—*Planorbis contrerasi*. Enlarged.

Laguna de Chapala, State of Jalisco, collected by Prof. Francisco Contreras, March 1, 1920. Type No. 46,193.

While the shape is somewhat like that of *Planorbis tenuis exaggeratus*, of Lake Patzcuaro, this species differs by its solidity and especially by the strongly developed spiral sculpture. It is a very distinct species.

Physa solidissima Pils.

Laguna de Chapala. Dead specimens of this remarkably globose, heavy species are somewhat larger than the type, the largest measuring: length 11.3, diam. 9.5, length of aperture 9.9 mm. The rounded fold of the massive columella is prominent, as in the type.

It is hoped that living individuals can be secured. They may show differences from the ordinary *Physas*.

Anodontites jaliscoensis n. sp. Fig. 3.

The shell is oblong, the alt. 55 per cent. of the length, the diameter slightly less than one-third the length, moderately solid; isabella

color, paler buff toward the beaks, a little browner toward the lower margin, the epidermis thin with weak growth lines; under the lens showing radial bands of festooned striae in the middle part. Beaks small, somewhat worn, showing no sculpture. The interior is pale Payne's gray with a rather wide matt border; stained with olive-buff in the cavity toward the beaks. There is a dark, iridescent triangle at the posterior end of the hinge.

Length 46, alt. 25.5, diam. 14 mm.

Tolimán, State of Jalisco. Prof. F. Contreras. Type No. 46,197.

This is a longer shell than *Anodonta coarctata* Anton, differing also in external texture, the wide dull border inside, and the deep, triangular "sinulus" at the end of the hinge.

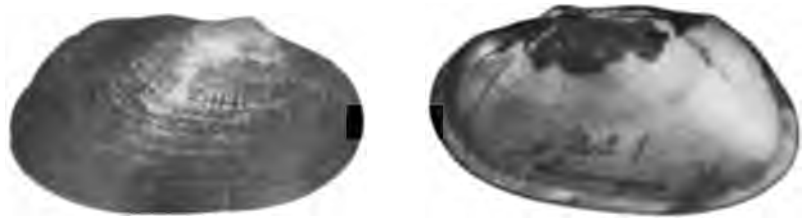


Fig. 3. —*Anodontites jaliscoensis*. Natural size.

Nephronatis aztecorum tolimanensis new subspecies. Fig. 4.

Differs from *N. aztecorum* and *N. a. chapalensis* by the smaller size and lower form, the shell not so wide posteriorly.

Length 43, alt. 24.3 mm.

Length 35, alt. 19.3, diam. 11.4 mm.

Tolimán, State of Jalisco. Type No. 46,195.

A specimen from Rio Grande, Zapotitlan, Jalisco, measures: length 54, alt. 28 mm.

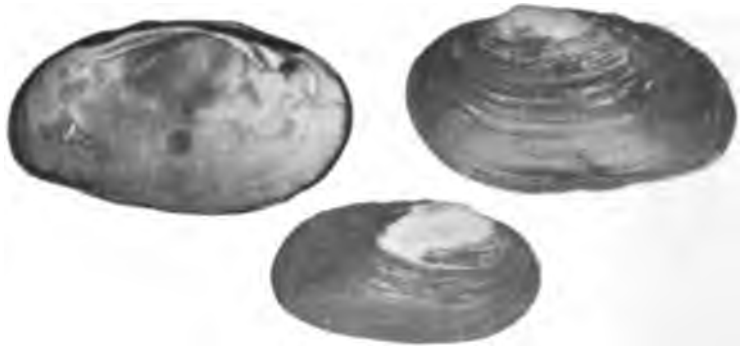


Fig. 4. —*Nephronatis aztecorum tolimanensis*. Natural size.

MOLLUSCA FROM CENTRAL AMERICA AND MEXICO.

BY HENRY A. PILSBRY.

The following descriptions and notes are in continuation of those published in these PROCEEDINGS for 1919, pp. 212-223.

Further comparisons have shown that *Donax mediamericana* (op. cit. p. 222) is merely a form of *D. striata*. The differences depended upon are inconstant.

Scolodonta zeteki new species. Fig. 1.

The shell is discoidal, broadly umbilicate, almost flat above, thin, isabella colored, slightly translucent. The surface is glossy, finely striate above, more weakly so below. There are six narrowly coiled, slowly increasing, convex whorls, the last, at the aperture, nearly twice the width of the preceding, rounded at periphery and

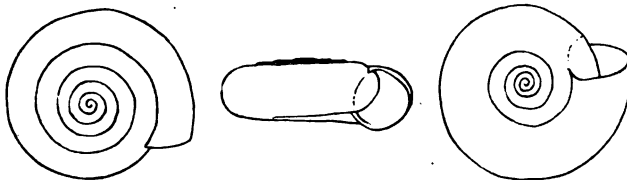


Fig. 1.—*Scolodonta zeteki*.

base, not descending in front. The umbilicus is conic, showing all of the whorls. The aperture is slightly oblique, lunate, higher than wide. Peristome thin and simple, the widely separated terminations joined by a very thin callus.

Alt. 4, diam. 10.9 mm.; 6 whorls. Gatun.

Alt. 3.4, diam. 9.1 mm.; 5.5 whorls. Gamboa.

Canal Zone: Gatun (D. E. Harrower); Gamboa (James Zetek).

Type No. 114,079, A. N. S. P.

Readily recognized by its discoidal form. There is a very closely related species in the collection from Venezuela without definite locality (R. Swift coll.; No. 23,775), whitish, with the whorls a trifle less closely coiled.

***Thysanophora textilis* new species. Fig. 2.**

The shell is umbilicate, conoid, the height and diameter about equal, pale brown. Sculpture of extremely low, subregularly spaced longitudinal waves, over all a microscopic granulation produced by the intersection of very minute striae and equally close spiral lines, giving the appearance of a fine woven material. First $1\frac{1}{2}$ whorls smooth. The whorls are very strongly convex. Suture very deeply impressed. Aperture somewhat semilunar, oblique, outer lip thin and simple, the columellar margin broadly dilated.

Alt. 1.8, diam. 1.8 mm.; 4 whorls.

Alt. 1.95, diam. 1.95 mm.; $4\frac{1}{4}$ whorls.

Chamá, Guatemala, A. A. Hinkley.

The microscopic sculpture is somewhat like that of the apex of *Drymaeus*, and unlike any *Thysanophora* I have examined. Whether the species belongs to *Thysanophora* or to *Pupisoma* is an open question, but the shape is rather more like the former.

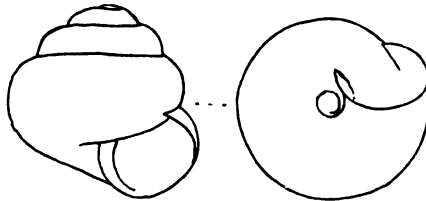


Fig. 2.—*Thysanophora textilis*.

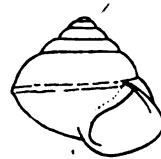


Fig. 3.—*Helicina oaxacana*.

***Helicina oaxacana* new species. Fig. 3.**

The shell is a little wider than high, with conic spire and bluntly carinate periphery, whitish, not glossy. Sculpture of fine growth-striae and fine, indistinct, protractive wrinkles, visible in places only. The whorls are rather strongly convex, the last having a blunt median keel, convex above and at the base. The aperture is semicircular, oblique. Outer lip is moderately expanded. Columella strongly concave on its ventral side, terminating in a projecting tubercle. Callus small, a groove behind the columellar side.

Alt. 4, diam. 4.5 mm.; $4\frac{1}{4}$ whorls.

Puerto Angel, Oaxaca, Mexico. C. R. Orcutt, 1910. Type No. 112,572, A. N. S. P.

This species appears related to *H. raresulcata* of Vera Cruz, but besides the somewhat diverse sculpture it differs by the angular periphery. The same character differentiates it easily from other small species of the region.

***Eutrochatella microdina chryseis* (Tristr.).**

Two specimens from Chamá measure: Alt. 4.2, diam. 3.83 mm., and Alt. 3.55, diam. 3.45 mm., respectively.

The color is barium yellow or between that and amber yellow. The size is about that given for *E. microdina*, but the proportions are between *microdina*, in which the alt. and diam. are 4 mm., and *chryseis*, alt. 4, diam. 3 mm. Perhaps *chryseis* may better be ranked as a subspecies of *E. microdina*.

In this connection it may be noted that Wagner in his monograph places *microdina* in both *Eutrochatella* (p. 138) and *Helicina* (p. 318). The species described at p. 318 is certainly not Morelet's species, which has been figured from author's specimens by Fischer and Crosse.

E. microdina, of which I have three from Morelet, is covered with excrement when alive. It is paler than *chryseis*, with the spire slightly lower, tapering with a wider angle, as Fischer and Crosse have pointed out.

E. simpsoni Ancy, from Utila Island, Honduras, is closely related, but the whorls project more prominently at the periphery, and the size is smaller. One of the original lot was figured in these PROCEEDINGS 1903, pl. 49, fig. 4.

These three forms belonging to the subgenus *Pyrgodomus* Crosse and Fischer, are now for the first time brought together.

COCHLIOPA Stimpson.

As this genus has doubled in number of species since the publication of the "Biologia Centrali-Americana" a catalogue of the species may be of use:

***Cochliopa riograndensis* Pils. & Ferr.**

Proc. A. N. S. Phila., 1906, p. 171, pl. 9, figs. 10-13. Nautilus, XXIII, p. 99.

Rio Grande (Ferriss and Pilsbry) to the Panuco River tributaries (Hinkley).

***Cochliopa compacta* Pils.**

Nautilus, XXIII, Jan. 1910, p. 99, pl. 9, figs. 4, 5.

Choy River, State of San Luis Potosi (Hinkley).

***Cochliopa picta* Pils.**

Nautilus, XXIII, Jan. 1910, p. 100, pl. 9, figs. 1, 2.

Choy and Ganina Rivers, State of San Luis Potosi (Hinkley).

***Cochliopa guatemalensis* (Morelet)**

Valvata guatemalensis Morelet, Testacea Novissima, etc., II, 1851, p. 22.
Fischer and Crosse, Miss. Sci. Mex., Moll. II, p. 302, pl. 48, figs. 2-2b;
pl. 50, figs. 1-1b.

Cochliopa guatemalensis (Morel.) v. Martens, Biologia, p. 428.

Rio Michatoya near Istapa, southern Guatemala.

***Cochliopa rowelli* (Tryon).**

Amnicola rowelli Tryon, Proc. A. N. S. Phila., 1863, p. 147, pl. 1, figs. 8, 9.
Cochliopa rowelli Tryon, Stimpson, Smithsonian Misc. Coll. No. 201, 1865,
p. 50. W. G. Binney, Land and Freshwater Shells of N. A., III, p. 73,
figs. 144. Pilsbry, Nautilus XIX, 1905, p. 91. J. Rowell, Nautilus, XX,
p. 10.

Panama (W. Newcomb); Rio Matasnillo, Las Sabanas, Panama
(J. Zetek).

This species has been omitted from works on Central American mollusks because it was reported from California by the Rev. J. Rowell, who collected the original specimens. No other Californian conchologist has found it in the places he mentioned, but it has been taken in Panama by Dr. Wesley Newcomb many years ago, and recently by Mr. James Zetek. There can be no reasonable doubt that Mr. Rowell was mistaken in the locality, and really picked it up on his way to California by the Panama route.

***Cochliopa tryoniana* Pils.**

Nautilus, IV, 1890, p. 52. Proc. A. N. S. Phila., 1891, p. 331, pl. 15, fig. 12.
Biologia, p. 428, pl. 33, figs. 9-9c.

Western Nicaragua, southwestern Costa Rica.

***Cochliopa trochulus* Martens.**

Biologia, p. 429, pl. 23, fig. 7.

Southwestern Costa Rica (Pittier and Biolley) to Panama (James Zetek).

***Cochliopa infundibulum* Martens.**

Biologia, p. 429, pl. 23, fig. 3.

Guatemala.

Another related species was taken at Esmeralda, Rio Dulce, Guatemala, by Mr. Hinkley. This, I understand, will soon be described, making in all twelve species of *Cochliopa*.

***Cochliopa hinkleyi* new species. Fig. 4.**

The shell is minute, *planorboid*, with a very wide, shallow umbilicus and a *slightly concave spire*. Color brownish corneous. The three whorls are oval in section, the last descending slowly and at the end, only very shortly in contact with the preceding. Sculpture of numerous subequal, rather sharp spiral threads separated by

wider intervals, a narrow plain band below the suture and a wider one within the umbilicus. The aperture is slightly oblique, rounded-oval, the peristome very shortly adnate in adults (or sometimes very shortly free, continuous).

Alt. 0.75, diam. 1.75 mm.

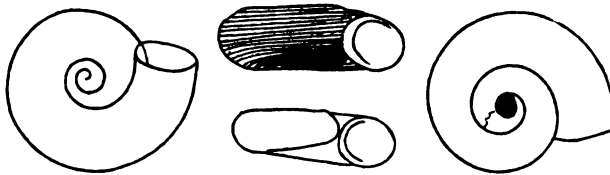


Fig. 4.—*Cochliopa hinkleyi*.

Lake Izabal near Jocolo, Guatemala, A. A. Hinkley.

With the sculpture of *C. guatemalensis*, this species has the shape of a small *Planorbis* of the *parvus* group. In most adult shells the inner whorls are eroded away, leaving a hole through the center of the disc, as in the right hand figure. Sometimes the last whorl is shortly free, as in the lower figure.

Cochliopa minor new species. Fig. 5.

The shell is depressed, umbilicate (the umbilicus rapidly enlarging in the last whorl, contained five times in the diameter), solid, very pale brownish. The spire is very low conic. The first of the four whorls is smooth; spiral ridges set in on the second; on the last there are about 23 of these ridges, nearly equal, and a little narrower than the concave intervals; the latter showing microscopic growth-lines and traces of fine spirals in some places. The last whorl is rounded peripherally, and descends slightly to the aperture. Aperture is strongly oblique, rounded. Peristome blunt, the margins joined by a heavy parietal callus.

Alt. 1.2, diam. 2.1 mm.; 4 whorls.

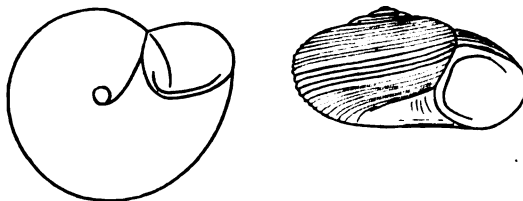


Fig. 5.—*Cochliopa minor*.

Polvon, Nicaragua. Type and paratypes No. 58,286, A. N. S. P., collected by the McNeil Expedition.

These specimens were formerly identified by the writer as *C. guatemalensis* (Morelet). The latter is much larger, diameter 3.5 mm., and came from the Michatoya River near Istapa, in southern Guatemala.

The teeth of the radula have denticles according to the formula $\frac{4.1.4}{3.3}$, 2.1.3, 13, ∞ . Those of the outer uncinus are very minute, not clearly seen. The lateral tooth has the boss and socket structure of the broad body, as in many other Amnicolidae.

Cochliopa izabal new species. Fig. 6.

The shell is conic, umbilicate (umbilicus narrow, rapidly widening in the last half whorl), rather thin; very pale brownish-gray; smooth except for faint traces of spiral striae, a little stronger near the umbilicus and sometimes on the penult whorl. The spire is elevated, the early whorls eroded. The whorls are strongly con-

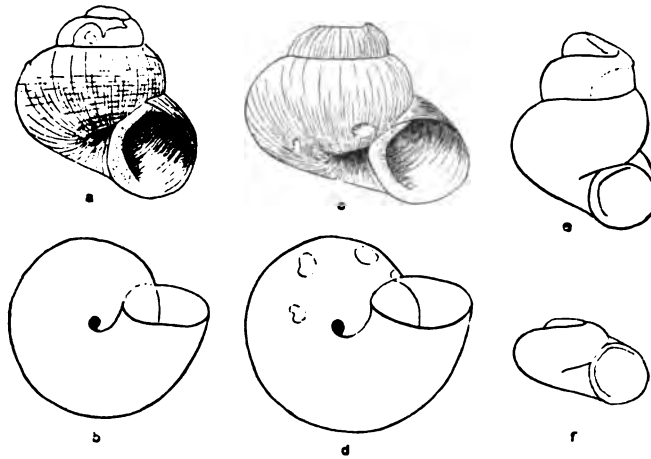


Fig. 6.—*Cochliopa izabal*.

vex, the last everywhere rounded. The aperture is moderately oblique, angular above, otherwise rounded. The outer lip is thin; columella concave, thickened, continued in a callus across the parietal wall.

Alt. 1.75, diam. 1.9 mm. Type, fig. 5 a, b.

Alt. 1.7, diam. 2.15 mm. Fig. 5 c, d.

Alt. 1.85, diam. 1.5 mm. Fig. 5 e.

Lake Izabal near Jocolo, Guatemala.

The nearly smooth form is selected as typical because it predominates in the lot collected. In some examples no spiral sculpture is visible; others are slightly to distinctly striate. The spire is always eroded, even in the smallest taken, diameter 1.3 mm., of 3 whorls (fig. 5f), but the summit would be obtuse if perfect, the early whorls increasing the shell rapidly in diameter. At this stage it has the normal shape of *Cochliopa*. Later the whorls descend more rapidly, giving it a somewhat Amnicoloid outline. Fig. 5e represents the narrowest specimen found.

Mutation *perstriata* (Fig. 7). Occurring with the smooth and moderately striate specimens there are a few having many strong spiral threads at all post-embryonic stages of growth, as in *C. guatemalensis*. The largest specimens are of this kind. Alt. 2.7, diam. 2.75 mm.

This species differs conspicuously from *C. guatemalensis* (Morel.) by its elevated spire. A large series was collected.



Fig. 7.—*Cochliopa izabal* mut. *perstriata*.

NAMES APPLIED TO *PACHYCHILUS*.

Pachychilus I. and H. C. Lea, Proc. Zool. Soc. London 1850, p. 179, for *P. cummingii* Lea [= *graphium* Morel.]. Not *Pachychila* Eschscholtz, Zoologischer Atlas, 4tes Heft, 1831, p. 5 (Coleoptera).

Cercimelania Fischer and Crosse, Mus. Sci. an Mex., Moll. terr. et Fluv., ii, p. 327, 1892, type *P. liebmanni* Phil.

Glyptomelania F. and C., op. cit. p. 328, type *P. glaphyrus* Morel.

Ozymelania F. and C., op. cit. p. 328, type *P. schiedeanus* Phil.

Sphaeromelania Rovereto, Atti della Società Ligustica di Sci. Nat. e Geogr., X, 1899, p. 109, new name for *Pachychilus* Lea.

The name to be used for this genus depends upon whether *Pachychilus* and *Pachychila* are considered to be different names. They

are of course of identical derivation; so are Louis and Louise, Francis and Frances, which serve very well. Until there is a definite ruling by the International Commission, it may be as well to continue to use the familiar *Pachychilus*.

Those who consider *-us* and *-a* names identical can adopt *Cercimelania*, type *liebmanni* Phil., proposed as a subgenus of *Pachychilus*.

NEW LAND SHELLS.

BY E. G. VANATTA.

Odontosagda havanensis new species. Pl. VI, figs. 1, 2, 3.

Shell small, thin, opaque, pinkish grey; apex obtuse, rather large, and smooth; spire depressed conic, composed of four and one half slowly increasing, vertically striate whorls; suture moderately deep; last whorl obtusely angular above the periphery, not descending in front; base obtusely conic, with a wide, perspective, well-like umbilicus. The surface of the base is provided with irregular incremental striae, and under a strong lens showing spaced spiral striae. Aperture lunate; peristome sharp, evenly arcuate, within the lip provided with one large white tooth in the basal region below the periphery, and a smaller white tooth near the base of the narrow columella.

Alt. .77, diam. 1.25, alt. of aperture .42, diam. .51 mm.

Picked from red earth collected under bushes in front of the Country Club at Havana, Cuba, by Louis H. Bregy in March, 1920.

The type is tray number 46,077 in the collection of The Academy of Natural Sciences of Philadelphia.

This species is smaller than *Odontosagda hillei* (Gundl.); *O. abbotti* Van. is larger and less angular near the periphery; and *O. blandi* (Weinl.) is more elevated.

This new *Odontosagda* was associated with *Praticolella griseola* (Pfr.), which has not been reported from Cuba before; also *Volvidens trichostoma* (Pfr.), *Urocoptis poeyana* (Orb.), *Guppya gundlachi* (Pfr.), *Caeciloides gundlachi* (Pfr.), and *Ennea bicolor* Hutton.

Zonitoides bregyi new species. Pl. VI, figs. 6, 7, 8.

Shell small, thin, translucent, corneous, shining; apex smooth, rather acute; spire low-conic; suture moderately deep; whorls about four, sculptured with irregular incremental striae, and under a strong lens showing fine undulated spiral lines; periphery evenly arcuate; base convex, provided with a deep umbilicus, surface shining, showing a few growth lines, and under a strong lens fine undulated spirals

may be seen; aperture semilunate; peristome thin; columella slightly reflexed; parietal wall thin.

Alt. 1.3, diam. 1.88, alt. of aperture .75, diam. .88 mm.

Picked from leafmould collected at the Costa Mine, about 15 miles from Bueicito, Prov. Oriente, Cuba, by Louis H. Bregy in March, 1920.

The type is in the cabinet of The Academy of Natural Sciences of Philadelphia, being tray number 46,089.

This species has narrower whorls and smaller umbilicus than *Zonitoides maya* Pils.; *Z. paraensis* Bkr. is smaller; and *Striatura neomexicana* Pils. has a wider umbilicus, fewer whorls, is more depressed, and has a duller surface.

Caecilioides domingensis new species. Pl. VI, fig. 15.

Shell small, subcylindrical, translucent corneous; apex obtuse; spire high, composed of four and one half moderately convex whorls; suture rather deep; surface shining, sculptured with a few irregular incremental striae; base convex, imperforate; aperture about one-third the altitude of the shell, oval, narrow above and broader below; lip acute, slightly arcuate; basal lip convex; columella truncate, comparatively thick, concave; parietal wall nearly straight; parietal callus thin.

Alt. 2.27, diam. .79, alt. of aperture .75, diam. .54 mm.

The types are tray number 44,654 in the Academy's collection, and were picked from earth collected by Dr. W. L. Abbott, one mile northwest of Sanchez, Santo Domingo.

This species has a deeper suture, more convex whorls, and a more obtuse apex than *Caecilioides consobrina* Orb.

Opisthosiphon maynardi new species. Pl. VI, figs. 9, 10, 11, 13.

Shell conical, thin, opaque, reddish brown above and greyish-yellow below, and a white line composed of sharp points at the suture; apex truncate, widely perforate, provided with a bluish plug of shell matter in the end of the decollated whorl; spire high, conic, composed of nearly four convex whorls; suture deep, acutely dentate; the last whorl free from the penultimate whorl near the aperture and again united to it by the parietal callus; last whorl evenly arcuate, provided with two slightly thickened, white, spiral lines near, and four others visible within, the umbilicus. The surface of the shell has a dull silk-like sculpture, and many very indistinct vertical costae, about sixty on the penultimate whorl; body whorl nearly smooth near the aperture; aperture entire, wide, ellip-

tical, with a raised, smooth rim in advance of the broadly expanded, flat, white lip, which is provided with several, slightly raised, concentric lamellae; outer lip forming at the suture a recurved hollow tube connecting the deep suture openly with the interior of the aperture by a small round pore. The broadly expanded basal and columellar lips showing faint white thickenings at the ends of the above-mentioned spirals; parietal lips expanded into a broad flat plate with its edge attached to the body-whorl, the concentric lamellae upon its surface are interrupted in an oblique line above the pore in the aperture, forming a small bay in the upper edge near the outer lip. Operculum, thick, calcareous, paucispiral, smooth within, composed of about three rapidly increasing volutions; nucleus below the middle; outer surface with a deep spiral groove with a raised irregular edge arising near the nucleus, continuing along the suture and completely around the outer edge of the operculum; the surface is also covered with coarse raised lamellae in the direction of the lines of growth.

Alt. 11.2, diam. 6.3, alt. of aperture 5.0, diam. 4.4 mm.

The types are in the cabinet of the Academy, being tray number 44,488, collected at Nassau, New Providence, Bahama Islands, by Mr. C. J. Maynard in 1888.

One specimen has the apex almost entire and is composed of about seven whorls; another (fig. 11) which is not quite mature, has a broad open bay at the upper angle of the aperture disconnecting the parietal wall and outer lips, and lacks the raised rim about the inner edge of the mouth; some specimens are uniform greyish yellow.

This species differs from *Opisthosiphon bahamensis* (Shutt.) by being smoother, having weaker, more spaced vertical costae, finer crenulations at the suture, and a wider expanded lip; *O. moreletiana* (Pet.) has stronger costae, and the aperture is free from the body whorl; *O. excurrens* (Gundl.) is more strongly costate, obese and cylindrical.

***Helicina abbotti* new species.** Pl. VI, figs. 12, 14.

Shell small, globose, moderately thick, opaque yellowish corneous; apex obtuse; spire elevated, conic, composed of four arcuate whorls; suture moderately impressed, not descending at the aperture; periphery convex; surface smooth, shining, with a few oblique lines and incremental striae crossed by very indistinct spiral lines visible under a lens. The base is rather flat, carinate about the edge of

the deep umbilical rimation; aperture subtriangular; outer lip slightly thickened, narrowly reflexed, descending in a nearly straight line to the convex periphery; basal lip sinuous, narrowly reflexed; columella thick, concave at the edge of the umbilical rimation; parietal callus broad, heavy, linguiform, and granulate; operculum not found.

Alt. 2.1, diam. 2.8, alt. of aperture 1.1, diam. 1.4 mm.

The types are in the collection of the Academy, being tray number 44,370, and were picked from earth collected one mile northwest of Sanchez, Santo Domingo, Hayti Island, by Dr. W. L. Abbott, during February, 1919.

This species differs from *Helicina (Artecallosa) continua* (Gundl.) Poey by having broader parietal callus, smaller umbilical rimation, a more sinuous basal lip, a broader columella, a more obtuse spire, and is smaller and more globose.

Stoastoma domingensis n. sp. Pl. VI, figs. 4, 5.

Shell small, conic, thin, opaque, greyish white; apex rather obtuse, smooth; spire high, conic, slightly concave sided, composed of five and one half convex whorls; body whorl contracted and free near the aperture; suture impressed, descending in front; periphery evenly convex; base convex; umbilicus minute. The surface of the shell is sculptured fine spiral hair lines, of which nine are visible on the penultimate whorl, about nineteen on the body whorl, and sixteen on the base, the growth lines are very indistinct; last whorl provided with a smooth band near the aperture; aperture semi-lunate; peristome continuous; outer lip evenly arcuate; basal lip acute; columella arcuate, slightly thickened; parietal wall nearly straight, rather thick, free from the penultimate whorl.

Alt. 2.47, diam. 2.26, alt. of aperture .89, diam. 1.04 mm.

The type is in the collection of the Academy, being tray number 44,372, picked from soil collected by Dr. W. L. Abbott, one mile northwest of Sanchez, Santo Domingo, Hayti Island.

This species is larger and more conic than *Stoastoma (Lindsleya) leanum* Ad., which it resembles in the shape of the aperture and sculpture.

NOTES ON ARACHNOIDISCUS.

BY SARAH P. MONKS.

While studying specimens of *Hemiptychus* (*Arachnoidiscus*), which are extremely abundant in many San Pedro, California, tidepools, an unusual form was found which may be called a variety of *Arachnoidiscus ehrenbergii*.

Instead of being circular with rays of equal length, it is blunt-cuneiform, with sides compressed and two sets of short rays. In all but shape and rays, even in various sizes and deformations, it is a true *Arachnoidiscus*, and I have called it *A. ehrenbergii* var. *cuneatus*.

It is quite abundant, thirty specimens being found in thirty micro-mounts.

The change of shape is no doubt partly due to overcrowding, for although there are miles of tide-pools and millions of sea-plants to choose from, the diatoms are often on some plants in almost incredible abundance.

These alien epiphytes crowd on many different algae—on stiff *Gelidium*, stony Corallines, and even on the flexible stems of other plants. Sometimes in shallow tidepools nearer land which are exposed to winter cold, or summer heat, during very low tide; the diatoms are killed, and then the host plant is gray-coated like sleet-crusted trees in winter. But when alive the brown of the diatoms entirely covers the stem of the host like a shiny varnish, and the only chance the burdened alga has is for terminal growth. When the brown film dies, on exposure to the sun or the dry air, the whole colony shows the green of chlorophyll, and this green remains for years; then when nothing remains but skeletons the effect is grayish white and the diatoms still stick to the host plant. Not only are the algae burdened with "an innumerable host" of *Arachnoidiscus*, but there are co-dwellers, members of ten or more other genera.

The habits of these diatoms may account for the many and various irregularities of *Arachnoidiscus*. Species of *Isthmia* hang in festoons and swing away from the alga's stems, as do some *Biddulpha*

also; acicular species like *Lichmophora* and *Climacosphenia* shoot out at many angles, thus leaving *Arachnoidiscus* and other sedentary forms to bear the burden of growth-pressure. This intensive growth pressure in the struggle for existence in the overcrowded sea-tenement may be responsible for the many deformations of diatoms and the forming of *Arachnoidiscus ehrenbergii* var. *cuneatus*.

IRON ORE ARTIFACTS FROM ALABAMA.

BY H. NEWELL WARDLE.

The attention of the writer was recently called to a series of artifacts of peculiar form and unusual material—all surface finds, from Blount County, Alabama. Their owner and discoverer, Mr. E. S. Ginnane, a local private collector, being unable to account for their singular form, and noting no duplicates on display in the great museums of our cities, kindly sent a selection of the pieces to THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, and, these proving so interesting, followed them with the loan of his entire series for purposes of study.

The material is iron ore of varying grade—some hematite, some limonite. Many of the pieces, taken by themselves, might be considered as implements in the process of blocking out, but, brought into relation to the series, show a definiteness of purpose that calls for interpretation.

In general, the outline is amygdaloid, varying to oblong, with one plane surface and one more or less convex. The plane surface, and occasionally the lateral surfaces also, show signs of rubbing or polishing. Though some pieces thus approach the well-known *boat-stone* in form,¹ neither material nor finish permits their assignment to that class, and the objects are obviously tools. Their narrow ends are frequently flattened, squared or notched. This last peculiarity was the first to attract attention. Taken in conjunction with their relatively great weight, it seemed to throw them into the group of sinkers. But why the notch should have been placed on the ends, in preference to the sides, as in all recognized sinkers, remained a disconcerting problem.

A second possible explanation was their employment as weaving weights where a slender weight would have its advantage among the close-hung strands. Not all the pieces are notched, however, and, of those which are, some have the groove much shallower

¹A boat stone of ferruginous rock or limonite, resembling the specimen shown in Plate VII, fig. 1 was found by Mr. Clarence B. Moore, in the Mound near Chandler Landing, Prairie County, Arkansas. Moore, "Antiquities of the St. Francis, White, and Black Rivers, Arkansas." *Journ. Acad. Nat. Sciences, Philadelphia*, Vol. XIV, p. 346.

(Plate VII, fig. 5), or even absent (Plate VII, figs. 2, 6, 7) at one extremity.

Judged by material alone, all might be classed as paint-stones, for they are quite capable of rendering a red or red-brown paint. But, in that case, why were they ground into so special a form when any irregular shape would serve, as witness other specimens of identical material which bear evidence of such usage and which were collected from the same fields (Plate IX); while, on the other hand, an occasional artifact, not of iron-ore but of ordinary sandstone (Plate VIII, figs. 7, 8, 9), or even of fine-grained quartzite (Plate VIII, fig. 6), may offer the same general characters.

One quality is common to all the pieces under consideration, whatever their composition or their contour—namely grit. This would indicate that they were hones of convenient form for the dressing and finishing of small tools such as awls, needles, fish-hooks, etc. Only occasionally, however, do they exhibit the grooves on their flat surfaces which are attributed to the sharpening and pointing of such tools (Plate VII, fig. 10, Plate VIII, fig. 5.). Moorehead, in "The Stone Age in North America,"² figures two sandstone arrow- and needle-sharpeners from North Dakota, which have the form of the Alabama pieces under discussion, but are grooved from end to end on the face. It may be added that two of the irregular paint stones (or hones?), referred to above (Plate IX, figs. 6, 8) exhibit fine striae, apparently made by such work in sharpening tools, in one instance (Fig. 8), the groove having been partly obliterated by later grinding.

This usage leaves unexplained the notch upon the ends. Obviously it could not have served for the attachment of a thong to prevent loss for the notch is perpendicular to the flat surface of the tool, so that a thong would have traversed its working plane in all cases save in one piece, a very crude one, showing little use—an unthinkable attachment. Such is believed to have been the purpose of the groove which lies along the periphery of the beautiful boat-shaped hones and tool trimmers of Neolithic Scandinavia.³

The only hematite known to the writer, which appears to belong to this class, is in the Andover collection, and is described by Moorehead,⁴ as "a grooved hematite object, the groove extending around

² Vol. II, p. 314.

³ Nilsson, *The 'Primitive Inhabitants of Scandinavia'* (Nilsson on the Stone Age, edited by Sir John Lubbock), pp. 14, 15, Pl. I, fig. 8.

⁴ *Op. cit.* II, p. 306, fig. 700.

the periphery of the object." Unfortunately, it is impossible to be certain from the illustration, whether the piece is truly one of the group here described.

Actual experiment with the notched hones convinced the writer that the terminal groove had served for the dressing of thong or sinew, the tool being held comfortably in the closed hand, and the thong drawn through the hand and over the end of the stone, cutting more or less deeply into its end and the adjoining faces. This method of handling tends to slant the notch to the left—for right-handed workers. One specimen (Plate VII, fig. 7; text fig. 1) presents, in addition to its notched end, a series of five finer striae across one edge of the hone, apparently cut in by a slender sinew thread.

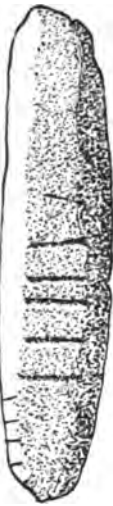


Fig 1.—Sinew scored edge of
Pl. VII, fig. 7.

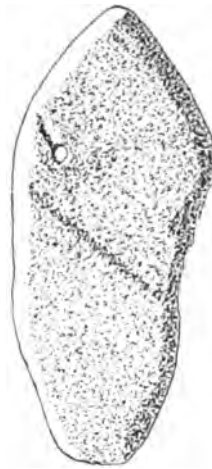


Fig 2.—Basal view of Pl. VII,
fig. 8.

In addition to the hones already described, there are, in the collection certain irregular pieces which call for special mention. One little hone (Plate VII, fig. 8; text fig. 2), which approaches in form the Antillian *Zemi* or "cocked-hat stone," has been drilled near one edge, probably for the attachment of a cord, which passed in a shallow groove over the edge of the artifact. The working down of the face through use has almost obliterated the groove, and possibly, by wear on the cord, accounts for the loss of the tool.

Another hone (Plate IX, fig. 9), likewise of oval outline on the flat face, is hollowed upon its opposite aspect, so that it comfortably fits the thumb when the piece is turned edgewise in order to use the lateral surfaces for abraiding—as has been freely done.

One of the most interesting tools is roughly quadrangular in outline (Plate IX, fig. 4). Evidence of long and hard service is apparent on one narrow side, as well as on the irregularly convex face and in the deep concavity of its opposite aspect. The curve of this hollow face is such as to suggest the spear-shaft and the paddle handle, or the curved back of a bow, as objects which it had served to finish, but the delicate friction lines, traversing lengthwise the wide groove, suggest a more resisting material than wood. Such a tool as this might have worked the bowl of a stone pipe or the handle of that monolithic axe from Moundville, Alabama.

Another of these artifacts is a little truncated pyramid (Plate IX, fig. 10), its narrow base worn off diagonally, the angles of its long sides sharply defined, and the apex broken away so as to leave in doubt the problem of its possible pendent form.

Lastly attention may be called to three pieces of worked hematite (limonite?) (Plate IX, figs. 1, 2, 3.) Upon the first (Plate IX, fig. 1) a mass of limonite crystals, the primitive artificer has just begun to work, as shown by a single rubbed surface. The second (Plate IX, fig. 2) has been roughly blocked into circular form, and the flat base and convex upper aspect offer patches of polished surface; while in the third (Plate IX, fig. 3) the grinding and polishing has progressed farther so that the object takes on the form of the well-known hematite cone. This piece was however far from finished, as attested by the still irregular contours and the rough depressions which the grinding down process has not yet reached.

To sum up: certain iron ore objects of amygdaloid or oblong shape, which, as a group, fall neither into the class of pendent ornaments, nor of weights used in fishing or weaving, are here identified as probable hones and sinew-dressing tools of a special form. It is hoped that the present study offers not only the description of a hitherto undescribed type of stone artefact, but its interpretation in terms of aboriginal life.

EXPLANATION OF PLATES VII, VIII, IX.

The numbers on the specimens refer to Mr. Ginnane's catalogue. All figures are shown natural size.

PLATE VII.—Artifacts of hematite and limonite.

Figs. 1, 2, 8.—Hones.

Figs. 3, 11.—Lower aspect of planoconvex hones.

Figs. 3, 4, 5, 6, 7, 9.—Sinew dressers and hones combined.

Fig. 10.—Tool sharpener and dresser.

PLATE VIII.—Iron ore objects and homologues of gritty stone.

Figs. 1, 5.—Hones of iron ore.

Fig. 2.—Iron-ore hone and sinew-dresser combined.

Figs. 2, 4.—Sinew dressers of iron-ore.

Fig. 9.—Sinew-dresser of sandstone.

Figs. 6, 7, 8.—Hones of quartzite and sandstone.

PLATE IX.—Irregular artifacts of hematite and limonite.

Figs. 1, 2, 3.—Stages of making hematite cones.

Fig. 4.—Concave rubbing stone, shaft-dresser.

Figs. 5, 8.—Tool sharpeners.

Fig. 6.—Heart-shaped artefact.

Figs. 7, 10.—Pyramidal rubbing stones.

Fig. 9.—Rubbing-stone socketed for thumb.

RECORDS AND DESCRIPTIONS OF BRAZILIAN ORTHOPTERA.

BY JAMES A. G. REHN.

The records and descriptions in the present paper have been accumulating for approximately five years during the study of more representative regional series of Brazilian Orthoptera. Aside from the geographic data here presented, the taxonomic and variational information thus sifted out and here brought together is of very considerable value.

Two hundred and nineteen specimens are discussed, representing one hundred and two species belonging to seventy-six genera, of which seventeen species and one genus are described as new. In addition it has been necessary to give one new generic name.

The material treated belongs almost wholly to THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, the Hebard Collection, which is on deposit at the Academy, the United States National Museum, the Museum of Comparative Zoology, and Cornell University, to the authorities of which institutions the author is indebted for the opportunity to study these collections. These institutions are indicated through the following pages by their respective initials.

BLATTIDAE.

ECTOBIINAE.

Anaplecta replicata Saussure and Zehntner.

1893. *Anaplecta replicata* Saussure and Zehntner, Biol. Cent.-Amer., Orth. I, p. 25, pl. IV, fig. [Pernambuco, Brazil.]

Bonito, State of Pernambuco. January, 1883. (A. Koebele.)
One male, three females. [U. S. N. M.]

These specimens are identical with material from Igarapé-assú, State of Pará, Brazil.

Anaplecta chrysoptera Shelford.

1906. *Anaplecta chrysoptera* Shelford, Trans. Entom. Soc. London, 1906, p. 247, pl. XVI, fig. 7. [Amazons.]

Bonito, State of Pernambuco. September, 1883. (A. Koebele; "on cotton".) One male. [U. S. N. M.]

This specimen does not fully accord with Shelford's description and figure, having but ten instead of thirteen costal veins to the wings and no blackish color on the palpi. In other features the individual fully agrees with the description and it seems desirable to tentatively refer it to *chrysoptera*.

PSEUDOMOPINAE.

Ischnoptera amazonica Rehn.

1916. *Ischnoptera amazonica* Rehn. Trans. Amer. Entom. Soc., XLII, p. 225, pl. XIV, figs. 4 to 8. [Igarapé-assu, Pará, Brazil (type); Pará, Brazil; Independencia, Parahyba, Brazil; Ceará, Brazil; Piunuha to Concha Huaya, Peru.]

Bonito, State of Pernambuco. February 18, 1883. (A. Koebele.) One male. [U. S. N. M.]

This specimen has been compared with the typical material. The present record extends the range of this species a short distance south along the coast.

Neoblattella conspersa (Brunner).

1865. *Phyllodromia conspersa* Brunner, Nouv. Syst. Blatt., p. 106. [Brazil.]

Bonito, State of Pernambuco. January-February, 1883. (A. Koebele.) Five males, one female. [U. S. N. M.]

These specimens are somewhat paler than the average of a large series from the state of Pará, with the usual pronotal pattern greatly reduced, faintly indicated or even absent. In all the tegminal punctulations are indicated although never strongly so.

EPILAMPRINAE.

Notolampra gibba (Thunberg).

"1826. *Blatta gibba* Thunberg, Mém. Acad. Imp. Sci. St. Petersb., X, p. 279."

Pernambuco, State of Pernambuco. January 2, 1883. (A. Koebele.) One male. [U. S. N. M.]

This specimen shows no trace of the median brown pronotal line mentioned by Saussure in describing the synonymous *lucida*.

All the previous exact records given for the species are from Bahia.

Phoraspis picta (Drury).

1782. [*Blatta*] *picta* Drury. Illust. Exot. Entom., III, p. 76, ind. (2), pl. 50, fig. 3. [Rio de Janeiro, Brazil.]

Santa Catharina. One male. [Hebard Cln.]

***Epilampra fallax* Saussure and Zehntner.**

1893. *Epilampra fallax* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 64. pl. IV, fig. 36. [Santa Catharina. Brazil.]

Santa Catharina. One female. [Hebard Cln.]

Rocha Nova, Serra do Mar, State of Parana. One female. [A. N.S. P.]

These specimens are typical of the species.

***Epilampra imitatrix* Saussure and Zehntner.**

1893. *Epilampra imitatrix* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 63. [Brazil.]

Chapada, State of Matto Grosso. October. One female. [U. S. N. M.]

This specimen differs from the description in several features, but as the species was based on the male sex these are probably only sexual. The tegmina are somewhat shorter and the pronotum of smaller size, but the other characters are in accord. The supra-anal plate is narrowly divided mesad.

This is the first record of the species with exact locality.

***Epilampra latifrons* Saussure and Zehntner.**

1893. *Epilampra latifrons* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 66. [South America.]

Pernambuco, State of Pernambuco. (J. C. Fletcher.) One male. [M. C. Z.]

This specimen, which is the first of the species recorded with exact locality, fully agrees with the description except in a few features which appear to us to be matters of variation or interpretation. The interspace between the eyes is exceptionally broad for the male sex, but is not quite twice as wide as the depth of the eye; the intercalated area is represented by a slight but distinct fold, while the supra-anal plate is sub-bilobate instead of having its margin entire as described. In every other respect the specimen is in exact accordance with the description, and differs from the related *azteca*, with which it has been compared, in the differences given by the original describers.

***Epilampra atriventris* Saussure.**

1895. *E[pilampra] atriventris* Saussure, Revue Suisse de Zoologie, III, p. 357. [Brazil.]

Santa Catharina. One female. [Hebard Cln.]

This specimen fully agrees with the original description except that the tegmina are slightly longer (22.6 mm.) and the supra-anal plate is not minutely incised mesad. The latter features is probably one which varies on account of the, at most, very delicate character of that area of the plate. This is the first record of the species with exact locality.

PANCHLORINAE.

Panchlora prasina Burmeister.

1838. *P[anchlora] prasina* Burmeister, Handb. der Entom., II, abth. II, pt. 1, p. 507. [Rio de Janeiro, Brazil.]

Piquete, State of São Paulo. January, 1901. One female. [A. N. S. P.]

Santa Catharina. Two females. [Hebard Cln.]

These appear to be the first exact records published since the original description of the species. One of the Santa Catharina females is smaller than the other individuals of this exceptionally large species.

BLABERINAE.

Petasodes dominicana (Burmeister).

1838. *M[onachoda] dominicana* Burmeister, Handb. der Entom., II, Abth. II, pt. 1, p. 514. [Brazil.]

Santa Catharina. One male. [A. N. S. P.]

River Una, forty-six miles south of Bahia, State of Bahia. (A. de Lacerda.) One male. [Hebard Cln.]

Monastria biguttata (Thunberg).

"1826. *Blatta biguttata* Thunberg, Mém. Acad. Imp. Sci. St. Pétersb., X, p. 276, pl. 14."

Teffe (Ega), State of Amazonas. (Roulin; Thayer Expedition.) One male. [Hebard Cln.]

Rio dos Macacos, State of Pará. (Thayer Expedition.) One male. [M. C. Z.]

Rio de Janeiro, State of Rio de Janeiro. (Thayer Expedition.) One male. [M. C. Z.]

We have not been able to examine the original description of this species, volume ten of the "St. Petersburg Memoirs" being lacking in our set of that publication. However, the specimens before us accord with the interpretation of the species presented by Serville and Brunner, and have the cephalic margin of the pronotum lined with fuscous and the costal margin of the tegmina without any contrasted pale edging. The specimens previously recorded by us as this species, from Yaguarasapa, Paraguay¹ and Misiones, Argentina,² together with two other males now before us from Puerto Cantera (X, 1913; C. Schrottky) and Alto Paraná (II, 1914; C. Schrottky), Paraguay, belong to the form called *similis* by Serville. This has the cephalic margin of the pronotum deep ochraceous-orange and

¹ Entom. News, XXII, p. 248 (1911).

² Proc. Acad. Nat. Sci. Phila., 1913, p. 293, (1913); Ibid., 1915, p. 275, (1915).

the costal margin of the tegmina largely edged with the same. Whether *similis* should be considered a distinct species or merely a chromatomorph of *biguttata* we cannot say at present, an uncertainty shared with Brunner and Saussure, but it is our opinion that, tentatively at least, it should be considered worthy of specific rank. Aside from the color features the female appears to differ in the tegmina being longer than in *biguttata*, and of sufficient length to cover half of the dorsum of the abdomen. All the material we have referable to *similis* is of considerably larger size than that referred to *biguttata*, also much surpassing the measurements given in both of the original descriptions, but this, we feel, may be individual or geographic in character.

***Monastria cassidea* (Eschscholtz).**

1822. *Blatta cassidea* Eschscholtz, Entomographien, p. 87. [Santa Catharina, Brazil.]

Theresopolis, State of Santa Catharina. One female. [Mus. Comp. Zool.]

It may be necessary in the future to remove this species from the genus *Monastria*, as there is a very great amount of difference between *M. biguttata*, the type of *Monastria*, and this species.

CORYDIINAE.

***Euthyrrhapha pacifica* (Coquebert).**

1804. *Blatta pacifica* Coquebert; Illustr. Inconogr. Insect., III, p. 91, pl. XXI, fig. 1. [Islands of the Pacific Ocean.]

Piquete, State of São Paulo. One male. [A. N. S. P.]

PERISPHERINAE.

***Hormetica scrobiculata* Burmeister.**

1838. *H[ormetica] scrobiculata* Burmeister, Handb. der Entom., II, abth. II, pt. 1, p. 512. [Bahia, Brazil.]

Amazons. One male. [A. N. S. P.]

As pointed out elsewhere⁴ we consider this name to represent a species well separated from *H. laevigata* Burmeister, with which it is usually synonymized.

³ We have recently had occasion to examine the type of Scudder's *Hormetica advena* (Proc. Davenport Acad. Nat. Sci., VIII, p. 94) described from a specimen, unquestionably introduced, taken at Belmont, Massachusetts. It is a well marked species, characterized by lateral tegmina such as are found in *Parahormetica*, but having strongly developed tarsal arolia as in *Hormetica*. Its closest relationship is, however, not with *verrucosa* as stated by Scudder, but with *subcincta* Walker, from which it differs in the tegmina being lateral instead of quadrate and attingent, in the pronotal "horse-shoe" being of relatively less area, less pronounced and differently colored, and in the pronotum being in general less compressed and less vaulted. Both species have shining black abdomens, margined laterad with ochraceous and the tegminal color similar.

⁴ Trans. Amer. Entom. Soc., XLIII, pp. 341-342, (1917).

MANTIDAE.
ORTHODERINAE.

***Mantoida burmeisteri* (Giebel).**

1862. *Ch[aetessa] burmeisteri* Giebel, Zeitschr. für die gesamt. Naturwiss., XX, p. 316. [Neu Freiburg, State of Rio de Janeiro, Brazil.]

Chapada, State of Matto Grosso. August. One male. [M. C. Z.]

This specimen has been compared with individuals of the species from the Rio Salado and the Misiones, Argentina. The range of the insect is considerably extended to the north-westward by the present record.

MANTINAE.

***Acontiothespis bimaculata* (Saussure).**

1870. *A[contista] bimaculata* Saussure, Mittheil. Schweiz. Entom. Gesell., III, p. 229. [Brazil.]

Goyaz, State of Goyaz. Two males. [Hebard Cln.]

We have compared these specimens with males from Sapucay, Paraguay and the Misiones and Jujuy, Argentina.

***Euryderes anisitsi* Brancsik.**

1897. *E[uryderes] anisitsi* Brancsik, Jahresh. Naturw. Ver. Trencsin. Comit., XIX-XX, p. 63, pl. I, fig. 9. [Fuerte Olimpo, Paraguay.]

Goyaz, State of Goyaz. Six males. [Hebard Cln.]

It was a surprise, as well as a pleasure, to recognize this previously little known genus and species in the present collection. The specimens fully agree with the original description and also, after allowing for a certain degree of roughness in the drawing, with the figure. Our specimens are all slightly larger than the original measurements, several appreciably so, but it is evident there is considerable individual variation in this respect. Superficially the present insect bears a considerable resemblance to the African Vatid genus *Danuria* and allied genera, the form of the head and pronotum much suggesting that found in the Old World group, but *Euryderes* is a true member of the Mantinae. Its position, however, appears to be removed from *Coptopteryx* and near *Photina* than the location given it by Kirby in his Catalogue. While distinctly aberrant in general features it would seem to us to fit more logically in a linear arrangement between *Metriomantis* and *Photina*.

The species was previously known only from the type locality.

***Photina brevis* Rehn.**

1907. *Photina brevis* Rehn, Proc. Acad. Nat. Sci. Phila., 1907, p. 156, figs. 1 and 2. [Sapucay, Paraguay.]

Goyaz, State of Goyaz. Two males. [Hebard Cln.]

These specimens have been compared with the type of the species. In this form the venation of the wing shows much individual variation in the number of rami of the principal veins. Both of the Goyaz specimens are somewhat larger than the Sapucay individuals (type and paratypes).

The present record extends the range of the species to the northward.

Angela infuscata (Chopard).

1911. *Thespis infuscata* Chopard, Ann. Soc. Entom. France, LXXX, p. 320. [Saint Jean du Maroni and Nouveau Chantier, French Guiana.]

Obidos, Rio Amazon, State of Amazonas. One male. [A. N. S. P.]

This specimen agrees with two cotypes of this species now in the Hebard Collection. The range of the form is extended southward into the Amazon valley by the present record.

MIOPTERYGINAE.

TRACHYMIOPTERYX¹ new genus.

This genus is nearer to *Pseudomiopteryx* Saussure and *Eumiop-teryx* Giglio-Tos than any others. Its relationship to *Pseudomiop-teryx* is much less intimate than that with *Eumiop-teryx*, and from the former the new genus can be immediately separated by the absence of a frontal spine and the angulation of the latero-cephalic sections of the pronotal margins. From *Eumiop-teryx* its differences are more subtle, yet distinctly evident. The basal outline form of the pronotum is much the same as in *Eumiop-teryx*, showing, however, a slight angulation to the expansion, which is suggestive of that found in *Pseudomiop-teryx*, but the dorsal surface has three pairs of pronounced tubercles; the vicinity of the transverse sulcus is strongly sellate; the occipital outline is distinctly arcuate emarginate, instead of subtruncate as in *Eumiop-teryx*, and the juxta-ocular lobes are decided and rectangulate; the facial shield is deeper in proportion, while the tegmina are more ample, as in *Pseudomiop-teryx*.

The present genus is apparently a type intermediate between the two genera with which it has been compared, but sufficiently distinct to be generically recognized.

Genotype.—*T. tuberculata* new species.

Trachymiop-teryx tuberculata new species. (Plate X, figs. 1 and 2.)

Type.—♂; Goyaz, State of Goyaz, Brazil. [Hebard Collection, Type no. 216.]

¹ From *τραχὺς* rough and *Miop-teryx*.

Size medium (for the subfamily); form but little elongate. Head with the greatest depth contained one and one-half times in the greatest width across the eyes; cephalic face of occiput moderately declivent mesad with a distinct but low and rounded boss or swelling, laterad of which are shallow, broad, depressed areas, in which the antennae lay when directed caudad; occipital outline, when seen from the cephalic aspect, distinctly though not deeply arcuate-emarginate, very faintly bulbous on each side immediately mesad of the juxta-ocular sulci, the juxta-ocular lobes distinct, elevated, slightly acute with the apices rounded; ocelli relatively large, moderately prominent, well separated, placed in an inverted, subdepressed triangle, their vicinity without a frontal production; facial shield transverse, its greatest depth contained three times in the greatest width; dorsal margin of shield arcuate mesad and arcuate-emarginate laterad, ventrad of the antennal scrobes; ventral margin of the shield arcuate-emarginate; the curve of the median section of the dorsal margin continued ventro-laterad over the plate by low ridges: clypeus transverse, its surface elevated in a distinct transverse ridge, highest mesad: eyes prominent, inflated, in basal outline short ovate, close to the internal margin of each eye, and between it and the nearest antenna and ocellus, is placed a pair of well separated tubercles, the dorsal of which is more pronounced than the ventral: antennae with the joints, aside from the proximal three, moniliform, the proximal joint relatively large.

Pronotum in general form intermediate between that found in *Pseudomiopteryx* and *Eumiopteryx*, the greatest width across the supra-coxal expansion contained about twice in the greatest length of the pronotum, which is nearly twice the least width, this being situated caudad of the middle of the shaft: collar with the lateral margins appreciably depressed ampliate, cephalic margin relatively narrowed, rounded, with a slight angle where it passes into the lateral section, thence the margins are straight and obliquely diverging to faintly before the middle of the shaft, where there is a distinct obtuse-angulate projection, the margins thence to the angle of the dilation divergent arcuate-emarginate; angles of the expansion obtuse, the immediate angles narrowly rounded; margins of the shaft regularly narrowing from the long expansion to the point of least width, thence faintly expanding to the arcuate caudal margin; lateral margins in the vicinity of the expansion minutely crenulate: collar occupying two-fifths of the length of the pronotum, its surface with a paired median tubercle and caudad of this a pair

of slightly more conical tubercles: shaft at cephalic third with a median bifid tubercle, the points of which are conical, immediately caudad of this is a pair of widely separated, low, conical tubercles, and about an equal distance from this pair, but on each lateral face of the shaft, is a pronounced conical tubercle, caudad of which and running dorso-caudad is a carinate ridge, stronger caudad, and fusing with a strumose area near the caudal margin, where there is a pair of elevated, longitudinally disposed projections, the crests of which are serrulate; median carination distinct but low caudad of the median paired tubercle on the collar; when seen from the side the region of the expansion is distinctly sellate, and the shaft less decidedly but still distinctly so.

Tegmina four and one-third times as long as the pronotum, its greatest width contained three and one-half times in the tegminal length, the greatest width at the distal third: costal margin appreciably ciliate, very briefly arcuate proximad and in distal third moderately arcuate to the rotundato-rectangulate apex, distal margin sutural of the apex broadly rounding into the sutural margin: marginal field coarsely reticulate; discoidal vein bifurcate at distal fourth; median vein bifurcate at middle; ulnar vein bifurcate near the base, the sutural ramus bifurcate immediately distad of the primary bifurcation, all rami of the median and ulnar veins reaching the sutural margin; anal vein arcuate in proximal half, thence straight oblique; axillary veins two in number, the sutural one bifurcate near its base; stigma distinct, slightly oblique, involving all veins from the median to the caudal ramus of the ulnar vein; areas between all veins of the discoidal field irregularly but rather openly and finely reticulate with cross-veins, which are less numerous in the immediate vicinity of the main veins than in the middle of the areas. Wings when in repose surpassing the apices of the tegmina by about the length of the collar of the pronotum, the apex rotundate-rectangulate: ulnar vein biramose, the proximal ramus diverging near the proximal third, the distal ramus diverging at about the distal third, the proximal ramus separated from the distal one by a considerable space, which narrows distad: discoidal field of the wing with the interspaces between the veins proximad with fairly regular cross-veins, which are much more oblique in some areas than in others, distad the cross-veins become irregular and anastomosing, except in the narrower fields where there is a general biseriate disposition.

Abdomen with the supra-anal plate transverse, triangularly produced mesad, moderately tectate, weakly carinate mesad, the apex

angulate; cerci moderately surpassing the subgenital plate, subequal in width, moniliform, slightly depressed, apical joint bluntly acuminate: internal genital plates which are apparent from the dorsum, lying in the hollow of the subgenital plate, are: on the right side a depressed, broad, narrowing and incurved plate, the apex of which is bluntly acuminate and slightly decurved; on the left and extending over to the center is a very broad, strongly depressed plate, which is in general obliquely subtruncate at the distal extremity and from the dorso-distal portion of which arises an erect, falcate process, which is curved to the left; ventrad of this plate lies a narrow, sinuato-falcate titillator, the apex of which is bluntly acuminate and reaches to the dextral internal plate: subgenital plate broad, depressed, saucer shaped, the margin sinuato-arcuate when seen from the dorsum, styles represented sinistrad by a strong acuminate appendage, the dextral equivalent of which is, possibly teratologically, a mere node.

Cephalic coxae subequal to the pronotum in length, subcompressed, external margin lamellato-carinate, all margins very finely and sparsely serrulate: cephalic femora nearly one and one-fifth times the length of the pronotum, distinctly compressed, the general form of the femur elongate sub-triquetrous, the greatest femoral depth contained about three times in the length of the same; dorsal margin of the femur lamellato-carinate, faintly sinuate; external face obsoletely granulose; ventro-external margin with five relatively short, conical spines, the distal one on the genicular lobe; ventro-internal margin with thirteen conical spines, which are arranged according to length in the following biseriate formula—(reading proximad) I IiIiIiIiIiIi; discoidal spines four in number, the second (reading proximad) much the longer; proximal section of the ventral surface with a median row of tubercles; cephalic tibiae (aside from the apical spur) half as long as the femora, moderately compressed, subcarinate on the extensor surface; external margin with a series of six distinct, adpressed spines on the distal half, these increasing in length distad and represented proximad by weak crenulations; internal margin with a continuous series of ten spines, which regularly increase in length distad; apical claw greatly elongate, falciform: cephalic metatarsi but little shorter than the tibiae, the remaining joints of the cephalic tarsi but slightly shorter than the metatarsi. Median and caudal limbs of medium length, relatively slender.

General color ochraceous-buff to ochraceous-tawny, very thickly and in general uniformly overlaid with a nebulous or punctulate

pattern of mummy brown to blackish-fuscous, which is in general so heavy that at first glance it is supposed to be the base color: eyes ochraceous-tawny overlaid with cloudings of blackish fuscous; ocelli zinc orange; antennae mummy brown on an ochraceous-tawny base: tegmina with the discoidal and all principal veins sutural of the same regularly checked with blackish fuscous, the base color of the veins being buffy, of the discoidal vein strongly ochraceous-buff, the general infumation of the tegmina weak mummy brown, with the immediate vicinity of the areal cross-veins hyaline; wings infumate similar to the tegmina, but proximad and on the radiate field more weakly so, the veins of the humeral field checked similar to those of the tegmina, the veins of the radiate field with a faint indication of similar but infrequent and attenuate checking; internal face of the cephalic coxae in general uniformly pale; internal face of the cephalic femora largely blotched with fuscous; cephalic tibiae with three rather indistinct bands of mummy brown; cephalic metatarsi with incomplete median and distal annuli of fuscous, remaining tarsal joints each uni-annulate, median femora obscurely tri- and caudal femora obscurely bi-annulate with fuscous clouds.

Length of body, 24.2 mm.; greatest width of head across eyes, 4; length of pronotum, 5.4; greatest width of pronotum, 2.8; length of tegmen, 23; greatest width of tegmen, 6.4; length of exposed portion of wing distad of tegmen, 2.4; length of cephalic femur, 6.1; length of caudal femur, 7.2.

The type of this interesting genus and species is unique.

***Eumiopteryx laticollis* Giglio-Tos.**

1915. *E[umiopteryx] laticollis* Giglio-Tos, Bull. Soc. Entom. Ital., XLVI, p. 141. [Paraguay; Province of Sara, Bolivia.]

Goyaz, State of Goyaz. One male. [Hebard Cln.]

This specimen agrees quite well with the generic and specific descriptions, although very slightly smaller than the original measurements for the sex. The individual has been much damaged about the wings and the median and caudal limbs, and in consequence certain venational features are not as clearly discernable as might be desired. The genus is not far distant from *Pseudomiopteryx*, and also close to the genus *Trachymiopteryx*, above described. The principal features of difference between the latter genus and *Eumiopteryx* are given under the diagnosis of *Trachymiopteryx*.

CNEPHOMANTIS⁶ new name.

1915. *Miopteryx* Giglio-Tos, Bull. Soc. Entom. Ital., XLVI, p. 139. (Not *Miopteryx* Saussure, 1869.)

1919. *Miopteryx* Giglio-Tos, Ibid., XLIX, p. 60. (Not *Miopteryx* Saussure, 1869.)

Giglio-Tos' recent reference of *Miopteryx granadensis* Saussure to a new genus *Promiopteryx*,⁷ as its genotype, is completely in error. His procedure is completely nullified by the first (the present author's) fixation of the genotype of *Miopteryx* as *M. granadensis*.⁸ Giglio-Tos was, doubtless, following Kirby's fixation of *rustica* as the genotype,⁹ but Kirby's fixation was made a number of months posterior to the indication of *granadensis*. The name *Promiopteryx* is, consequently, a pure synonym of restricted *Miopteryx*. It is necessary, therefore, to have a new generic name for the genus called *Miopteryx* by Giglio-Tos, and we are here proposing *Cnephomantis*, selecting as genotype the species described as *Miopteryx fuscata* by Giglio-Tos.

Cnephomantis¹⁰ *fuscatus* (Giglio-Tos).

1915. *M[iopteryx] fuscata* Giglio-Tos, Bull. Soc. Entom. Ital., XLVI, p. 139. [Brazil.]

Espírito Santo. One male. [Hebard Cln.]

This specimen fully answers the brief description of Giglio-Tos, but has the pronotum faintly shorter (4.6 mm. instead of 5).

Musoniella chopardi Giglio-Tos.

1913. *Miopteryx livida* Chopard, Ann. Entom. Soc. France, LXXXII, p. 759. (Nec *Thespis livida* Serville, 1839.) [Cuyaba, Matto Grosso, Brazil.]

1916. *M[usoniella] chopardi* Giglio-Tos, Bull. Soc. Entom. Ital., XLVII, p. 4. (Name for *livida* Chopard, nec Serville.)

Goyaz, State of Goyaz. One male. [Hebard Cln.]

This specimen is apparently inseparable from the insect erroneously determined as Serville's *Thespia livida* by Chopard, and later named *chopardi* by Giglio-Tos. The species is a rather aberrant *Musoniella*, showing, in its pronotal form and type of head, a tendency toward *Eumusonia*.

⁶ From κνέφας *gloom* and μαντίς *Mantis*, in allusion to the shaded forest habitat of many of these small Neotropical Mantidae.

⁷ Bull. Soc. Entom. Ital., XLVI, p. 138. (1915).

⁸ Proc. U. S. Nat. Mus., XXVII, p. 566, (February, 1904).

⁹ Syn. Catal. Orth., I, p. 274, (not earlier than November, 1904).

¹⁰ We find that Chopard in his recent key to the species of the genus *Miopteryx* as understood by him (Ann. Soc. Entom. France, LXXXII, pp. 760 and 761, (1913)), has misplaced certain of the features of the species *rustica* and *argentina*; the number of tibial spines given for *argentina* does not agree with the comments of the describer, Saussure, while the color features given for the same form are not those originally described, but instead those found in *rustica*. We have, tentatively, separated as *ciliata* the Misiones male taken April 19, 1910, and recorded by us (Proc. Acad. Nat. Sci. Phila., 1913, p. 294), from the other specimens there referred to *rustica*. It is the more infumate individual mentioned in the comments in that paper.

Musonia¹¹ *costalis* new species. (Plate X, figs. 3 and 4.)

This species is a quite interesting one, being on the borderland between the genus *Musonia* (*Promusonia* Giglio-Tos¹²) and *Musoniella* Giglio-Tos, but apparently nearer the former assemblage. When compared with a St. Laurent cotype of Chopard's *Mionyx fuscescens*,¹³ which is a member of the restricted genus *Musonia* and to which the new form is closely allied, *costalis* is seen to differ most strikingly in the deeper frontal shield, the shorter and broader pronotum, this showing *Musoniella* tendencies, the strongly infusate marginal field of the tegmina, which has a strikingly marked pale line on the costal margin, and in the infusate proximal sections of the transverse veins. The apex of the abdomen is lacking in the specimens seen. From *surinama*, the genotype, *costalis* is separated by a number of characters, the shorter pronotum and bicolored tegmina, with infusate bases to the cross-veins, being sufficiently distinctive in *costalis* to separate readily the two forms.

TYPE.—♂ (presumably); Goyaz, State of Goyaz, Brazil. [Hebard Collection, Type no. 217.]

Size small: form moderately elongate. Head much wider than the pronotal expansion, when seen from the cephalic aspect strongly transverse, the greatest depth contained one and one-half times in the greatest width: occipital line between the juxta-ocular sulci straight transverse, between the juxta-ocular sulci and the eyes the margins is slightly declivent and developed into low obtuse-angulate lobes, from the side the longitudinal angle of the occiput is seen to be slightly acute: ocelli large, but little separated, placed in a reversed, slightly depressed triangle: facial shield strongly transverse, the greatest depth contained two and one-half times in the

¹¹ We have nothing to add to our previous remarks regarding the generic name *Paramusonia* (Proc. U. S. Nat. Mus., XXVII, p. 567, footnote, (1904)), the indicated type of which is *Thespis cubensis* Saussure. Relative to Giglio-Tos' genus *Diamusonia*, based on *Mantis parva* Drury, all we can say is that we do not know the genotype, but we have a male of his species *media* from Caparo, Trinidad (April, 1913, S. M. Klages, [Hebard Cln.]) before us. However, the generic name cannot be maintained, as in February, 1904, the present author first definitely designated (Proc. U. S. Nat. Mus., XXVII, p. 565, footnote), the type of *Thespis* Serville as *Mantis parva*. In consequence the name *Diamusonia* must give place to *Thespis* Serville. Our species *Paramusonia seclusa* (Proc. Acad. Nat. Sci. Phila., 1913, p. 295, fig. 7, (1913)), from Alto Pencosa, Argentina, has been referred by Giglio-Tos (Bull. Soc. Entom. Ital., XLVII, p. 6, (1916)), to his genus *Promusonia* (= *Musonia* Stål), but a re-examination of the type shows no reason for us to change our assignment, as it does not appear generically separable from *cubensis*, the genotype of *Paramusonia*.

¹² Vide Rehn, Proc. Acad. Nat. Sci. Phila., 1918, p. 167, footnote 27, (1918).

¹³ Ann. Soc. Entom. France, LXXX, p. 333, (1911). [St. Laurent, La Forestiere and Nouveau Chantier, French Guiana.]

greatest width, dorsal margin of shield in general obtuse-angulate, slightly emarginate ventrad of the antennae; lateral margins slightly diverging dorsad; ventral margin faintly emarginate: eyes moderately prominent, not extending caudad of the general line of the head, in basal outline broad ovoid: antennae elongate, joint moniliform.

Pronotum moderately elongate, the greatest width across the expansion contained nearly four times in the length of the same: collar occupying about two-fifths of the pronotal length, the collar margins regularly diverging caudad to the moderately indicated expansion, the cephalic extremity of the pronotum regularly, but relatively narrowly, rounded; shaft of the pronotum appreciably broader than the collar, the margins almost subparallel, faintly diverging caudad, caudal margin subtruncate, all lateral margins sparsely but distinctly denticulate, expansion rounded; median carina distinct, weak cephalad on the collar; transverse sulcus well indicated; collar with lateral impressed areas throwing an elongate-elliptical dorsal medio-longitudinal area into relief.

Tegmina in length equal to about three times that of the pronotum: costal margin distinctly and regularly fringed with relatively short hairs, strongly rounding to the narrowly rounded but acute-angulate apex: marginal field narrow, proximal section weakly expanded, the field having in the broader proximal section a false longitudinal vein which forms a biseriate row of areolets: discoidal vein bifurcate at distal third, median vein biramose, ulnar vein biramose proximad; stigma nearly longitudinal, involving both distal rami of the ulnar vein and the proximal ramus of the median vein; axillary veins two in number, the distal one strongly sigmoid; interspaces between the veins of the discoidal field with false longitudinal veins, which make a biseriate disposition of the subrectangulate areolets. Wings surpassing the closed tegmina by about the length of the shaft of the pronotum, the apex slightly acute. Surface of the tegmina and of the exposed portion of the wings covered with short, plush-like, microscopic pile. Abdomen with the distal portion missing.

Cephalic coxae subequal to the pronotum in length, slender, strongly carinate, the margins unspined: cephalic femora equal to one and one-fourth the length of the coxae, slender, the depth hardly more than one-sixth of the length; ventro-external margin with five spines, one of which is genicular in position; ventro-internal margin with thirteen spines, which are arranged in the following formula (reading from the distal extremity) i i i i i i i i i i,

of which the first, fifth and sixth of the longer spines are more robust than the others of that category; discoidal spines four in number, the distal one small: cephalic tibiae slightly less than half the length of the femora, external margin with five spines, with a large proximal diastema, internal margin with nine spines, increasing in length distad, apical claw large: cephalic metatarsi very slender, elongate, in length faintly longer than the tibiae (without claw), proximad sigmoid, remaining cephalic tarsal joints about two-thirds as long as the metatarsus. Median and caudal limbs very elongate and slender, the median femora subequal to the pronotum in length, the caudal femora almost half again as long as the median femora.

General color wood brown, overlaid with a finely punctulate pattern and clouding of bone brown to fuscous. Head with the ocellar region solidly, and the facial shield almost solidly, fuscous; eyes broadly blotched with fuscous on the ground color; antennae of the general color, weakly infusate distad. Lateral portions of the pronotal shaft heavily blotched with fuscous. Tegmina snuff brown, the marginal field solidly clove brown, the costal margin narrowly but strikingly lined with light buff, this weakening distad; discoidal field with a very short section of each of the cross-veins adjacent to the longitudinal veins lined with clove brown; distad the longitudinal veins show a pencilling of clove brown. Exposed portion of wings colored similarly to the distal section of the tegmina. Limbs with the pale base color evident on the carinae of the coxae and femora; external face of the cephalic femora heavily clouded with fuscous, internal face with a heavy blotch of fuscous at the ungual groove; cephalic tibiae with three incomplete annuli composed of fuscous blotches.

Greatest width of head across eyes, 3 mm; length of pronotum, 5.6; greatest width of pronotum across expansion, 1.5; length of tegmen, 17.2; greatest width of tegmen, 4; length of cephalic femur, 4.9; length of caudal femur, 8.6.

The type of this species is unique.

***Eumusonina livida* (Serville).**

1839. *Thespis livida* Serville, Hist. Nat. Ins., Orth., p. 172. [Brazil.]

Goyaz, State of Goyaz. One male. [Hebard Cln.]

This specimen appears, in the light of Giglio-Tos' comments¹⁵ and a re-examination of all of Serville's remarks, to be the same as,

¹⁴ Bull. Soc. Entom. Ital., XLVII, p. 8, (1916).

¹⁵ Ibid., pp. 4, 5 and 8.

or extremely close to, Serville's species. The insect previously called *lvida* by Caudell¹⁶ and the present author¹⁷ is quite close, and we have identified it as *Eumysonia viridis* Giglio-Tos,¹⁸ which was recently described from a single male from Salto Grande, State of São Paulo, Brazil. The species *viridis* has both green and brown chroma-tomorphs, the green apparently the more infrequent, but a single specimen of it being in the series of six individuals of the species now before us.

***Thesprotia fuscipennis* Saussure and Zehntner.**

1894. *Thesprotia fuscipennis* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 171. [Rio de Janeiro, Brazil.]

Espirito Santo. One male. [Hebard Cln.]

This specimen is fully typical of the species, but unfortunately has the supra-anal plate damaged, as did the male type, so that the character of this important part is as yet unknown.

CREOBOTRINAE.

***Acanthops erosa* Serville.**

1839. *Acanthops erosa* Serville, Hist. Nat. Ins., Orthopt., p. 165. [Brazil.]

Bonito, State of Pernambuco. January, 1885. One female. [U. S. N. M.]

The present species, as we understand it, is quite close to *A. falcataria*, from which it readily can be separated by the narrower proximal section of the marginal field of the tegmina.

***Acanthops rehni* (Chopard).¹⁹**

1913. *P[lesi]acanthops rehni* Chopard, Bull. Soc. Entom. France, 1913, p. 55, figs. 1 to 3. [Gran Chaco, Argentina.]

Goyaz, State of Goyaz. Two males. [Hebard Cln.]

This species is extremely variable in size in the male sex, as a series of nine males from Sapucay, Paraguay, now before us, shows. Females from the latter locality are appreciably larger than the type measurements.

The genus *Plesiacanthops*, which was erected for *tuberculata* Saussure and the present species, does not appear to us to be very sharply distinguished from true *Acanthops*, three species (*brunneri*, *falcataria* and *erosa*) of which latter division are now before us. Chopard has

¹⁶ Journ. N. Y. Entom. Soc., XII, p. 184, (1904).

¹⁷ Proc. Acad. Nat. Sci. Phila., 1907, p. 158; Ibid., 1913, p. 205.

¹⁸ Bull. Soc. Entom. Ital., XLVII, p. 8, (1916).

¹⁹ This is the species recorded by us from Paraguay as *Acanthops sinuata* (Proc. Acad. Nat. Sci. Phila., 1907, p. 159). We are enabled to correct this determination by the acquisition of true *sinuata* (= *falcataria*) from the Guianas.

recently reduced *Plesiacanthops* from generic rank to that of a division or subgenus of *Acanthops*.²⁰

As the male sex of this species has not been described, a few notes may be of value:

♂. Sapucay, Paraguay. December 8, 1909. (William Foster.) [Hebard Collection.]

In general form differing from the female in the same fashion as males of the other species of the genus *Acanthops* differ from the females of their respective species. Form moderately slender, in general depressed, tegmina and wings well developed, considerably surpassing the apex of the abdomen. Head with its greatest depth contained one and one-third times in the greatest width of the head across the eyes; facial shield slightly more transverse than in the female; ocelli large, subcontiguous, placed in a depressed triangle; eyes much more produced than in the female, the apices more decidedly mammillate; antennae setaceous, but slightly heavier than in the female: surface of head with faint traces of the asperities found in the female.

Pronotum relative smooth, no trace of asperities being present; greatest width across the expansion contained three and one-third times in the greatest length of the pronotum, subequal to the length of the collar; expansion moderately indicated, rounded, margins entire, no median carina or depression indicated. Tegmina of the usual type found in the males of this genus, mortui-foliaceous, greatest width (which is at distal fourth) contained three and one-third times in the tegminal length; costal margin bisinuate, the distal one shorter longitudinally than the proximal one; apex subrectangulate with the angle slightly produced lobulate. Wings infumate, with the transverse veins of the anterior humeral and more distinctly of the radiate, but not of the posterior humeral, fields whitish, forming a distinct pattern; greatest width of the wing contained one and three-quarters times in the greatest length of the same; apex narrowly rounded rectangulate, costal margin in general straight, at the distal fourth rounded and thence to the apex oblique truncate.

Supra-anal plate subtransverse rounded trigonal; cerci not longer than the subgenital plate, subdepressed, subequal in width, the distal joint as long as the two preceding it and truncate at the extremity; subgenital plate shovel-shaped, subtrigonal, the distal

²⁰ Ann. Soc. Entom. France, LXXXV, p. 179, (1916).

extremity V-emarginate, the styles very brief. In structure the abdomen is lamellate as in the female, but in a slightly more reduced fashion; the dorsal black pattern is somewhat different; second segment with a transverse bar caudad, third segment with an arcuate figure distad taking up about two-thirds of its surface, fourth segment similarly but more completely occupied, fifth segment completely colored except that proximo-mesad the tone is weaker and brownish, sixth segment broadly bordered laterad and caudad with black, seventh segment distinctly and eighth and ninth segments faintly bordered caudad with blackish: venter of the abdomen with the structure of the segmental margins as in the male. Limbs of the type found in the female but much more slender.

Measurements of the described specimen: length of body, 41 mm.; greatest width of head across eyes, 5.8; length of pronotum, 11.5; greatest width of pronotum across expansion, 3.5; length of tegmen, 38.6; greatest width of tegmen, 11.5; length of cephalic femur, 10; length of caudal femur, 7.5.

VATINAE.

Oxyopsis lobeter Rehn.

1907. *Oxyopsis lobeter* Rehn, Proc. Acad. Nat. Sci. Phila., 1907, p. 159, figs. 3 and 4. [Sapucay, Paraguay.]

Goyaz, State of Goyaz. Three males. [Hebard Cln.]

The range of this species is now known to extend from the Misiones, northeastern Argentina north to Goyaz, Brazil.

Oxyopsis oculus new species. (Plate X, figs. 5, 6 and 7.)

A member of the section of the genus having produced and acute apices of the wings, and related to *O. rubicunda* (Stoll), from the Guianas, but differing from that species in the female sex in the less elongate pronotum, more decidedly trigonal sectional form of the shaft of the same, in the more produced (laterad) eyes, in the somewhat narrower marginal field of the tegmina, in the reduction in number and size of the hyaline areas of the discoidal field of the same, in the more acute tegminal apices, in the slightly more acuminate apices of the wings and in the relatively shorter median and caudal limbs. We are unable to compare the male very satisfactorily with *rubicunda*, owing to a lack of material of that sex of the older species, and the rather poor character of the available descriptions and figures of the same.

TYPE.—♀, Bonito, State of Pernambuco, Brazil. July 15, 1883. [United States National Museum.]

Size medium; form moderately slender. Head with the greatest width across eyes twice that across the expansion of the pronotum, when seen from the cephalic aspect the form of the head is depressed trigonal, the greatest depth contained one and five-eighths times in the greatest width across the eyes; occipital line subtruncate, rounding to the eyes laterad; region of the frons distinctly declivent, slightly concave; juxta-ocular sulci and the median pair of sulci well impressed on the frons; ocelli distinct, small, well separated, placed in a strongly curved line; facial shield transverse, its greatest depth contained one and two-thirds times in the greatest width, the dorsal outline of the plate transverse truncate mesad, obliquely truncate laterad, lateral margins vertical, ventral margin weakly arcuate-emarginate, surface of the plate with a few depressions laterad but no elevations excepting the dorsal and lateral margins, which are cingulate; clypeus and labrum transverse, eyes strongly produced laterad, when seen from the dorsum or from the cephalic aspect the production of the eyes is rectangulate, the apex submamillate, the cephalic surface of the eyes with a distinct convexity: antennae simple, setaceous, relatively short.

Pronotum elongate, the greatest width across the inflation contained slightly more than five times in the greatest length of the same, inflation little pronounced, the collar regularly narrowing from this to the rather narrowly rounded cephalic extremity, the shaft with the margins faintly concave, the least width of the shaft being at the median third, where the margins are briefly subparallel; lateral margins of the shaft distinctly dentate, the teeth sparser caudad, the margins of the collar closely denticulate, on the expansion proper the denticulations are few and weak; in section the shaft is strongly trigonal, median carina of the shaft fairly decided and continuous, collar with a medio-longitudinal impression, which is stronger caudad and there accompanied by a median carination, transverse impression well indicated.

Tegmina about one and one-fourth times as long as the pronotum, in form quite elongate elliptico-ovoid, the greatest width contained about three times in the greatest length; costal margin strongly arcuate proximad and distad but straight for the greater portion of its length mesad, apex subrectangulate with the immediate apex very narrowly rounded, sutural margin with the proximal third faintly arcuate, the distal fourth obliquely rounding to the apex: marginal field occupying about two-fifths of the width of the tegmen, gently broadening to the distal fourth, thence narrowing

to the apex; oblique rami in the marginal field nine in number, occasionally bifurcate; hyaline areolae of the proximal section of the discoidal and anal areas relatively few in number, not markedly conspicuous. Wings surpassing the apices of the tegmina by about one-third of the pronotal length, the exposed portion of the wings distinctly and regularly acute, the proximal width of the exposed portion contained one and one-third times in the length of the same section, the structure of the exposed area coriaceous; wing in general relatively long and narrow, its greatest width contained about twice in the total wing length. Abdomen incomplete.

Cephalic coxae about five-eighths as long as the pronotum, in section compressed triquetrous, dorsal (cephalic) margin with moderate spines, which are biseriate in length and somewhat irregular in disposition; cephalic femora equal to two-thirds of the pronotum, slender, little compressed; discoidal spines four in number; external margin with four large spines and a microscopic point on the genicular lobe; internal margin with fifteen spines, which are biserially arranged for length as follows (reading proximad), IiiIiIiIiIiIi: cephalic tibiae (exclusive of apical claw) slightly less than half as long as the cephalic femora, subcompressed, the claw heavy, external margin with eleven spines, which increase in length distad and proximad of which is a brief diastema, internal margin with sixteen to seventeen spines, which increase in length distad: cephalic metatarsi slightly shorter than the tibiae, faintly longer than the remaining tarsal joints. Median and caudal limbs elongate, moderately slender; median femora slightly longer than the cephalic coxae; caudal femora subequal in length to the shaft of the pronotum, caudal tibiae subequal in length to the femora; caudal metatarsi slightly shorter than the collar of the pronotum, the remaining tarsal joints faintly shorter than the metatarsus.

ALLOTYPE.—♂; same data as type. [United States National Museum.]

Differing from the description of the type in the following features. Size smaller; form more slender, as usual in males of this genus. Head with greatest width across eyes over two and one-half times that across the expansion of the pronotum, the form of the head more depressed, the greatest depth contained one and three-fourths times in the width across the eyes; occipital line more broadly transverse, hardly rounding to the eyes; ocelli large, closely placed in a triangle; facial shield strongly transverse, its greatest depth contained three times in the greatest width of the shield, the dorsal line of the plate

narrowly truncate mesad, broadly oblique truncate laterad, lateral margins truncate, distinctly converging ventrad, ventral margin decidedly arcuate-emarginate; eyes slightly more prominent than in the female; antennae lacking.

Pronotum very slender, its greatest width across the expansion contained more than five times in the length of the same, general form much as in the male, but the form of the inflation is more decided and the shaft is more strongly triquetrous, with the median carina decidedly indicated and the collar margins more subparallel; lateral margins very weakly crenulate, this more evident, though there far from decided, on the supra-coxal inflation. Tegmina missing. Wings two and one-fourth times as long as the pronotum, apices rotundato-rectangulate, these less coriaceous and less sharply differentiated than in the female. Abdomen with the apex missing.

Cephalic coxae with a single series of well-spaced spines; cephalic femora about five-eighths as long as the pronotum, armed as in the female; cephalic tibiae with one spine less on each margin than in the female. Caudal limbs missing.

Coloration of type and allotype have been completely destroyed by immersion in a liquid preservative, from which they were mounted. At present both specimens are ochraceous or brownish, with the eyes walnut brown. The wings of the male are hyaline with the tips brownish in the coriaceous section; the wings of the female are hyaline tessellate with yellow, which colors the vicinity of the cross-veins, the coriaceous section of the apices of the general tone. The tegmina of the female show sufficient contrast to warrant the assumption that the marginal field and probably a portion of the proximal section of the discoidal field were originally purplish or brownish, while the remainder of the discoidal and the anal fields were greenish or yellowish, the hyaline areas moderately contrasted.

Measurements (in millimeters).

	Greatest width of head (across eyes)	Length of pronotum	Greatest width of pronotum across inflation	Length of tegmen	Length of exposed coriaceous portion of wing	Width of exposed coriaceous portion of wing
♂, <i>allotype</i>	5.8	12.4	2.2	—	4.8	5.6
♀, <i>type</i>	8.6	23.2	4.2	29.5	7	5

	Length of cephalic femur	Length of median femur	Length of caudal femur
♂, <i>allotype</i>	8.5	8	...
♀, <i>type</i>	15.7	13.6	18

The type and allotype of this species are the only specimens we have examined.

Parastagmatoptera glauca new species. (Plate X, figs. 8 and 9.)

An interesting species related to *P. theresopolitana* and *pellucida* Giglio-Tos²¹, agreeing with those species in the non-tessellate wings and the subpellucid, non-fenestrate wings. From both of these species, however, *glauca* differs in its much smaller size, more weakly denticulate lateral margins of the pronotum, the narrower marginal field of the tegmina and impunctate stigma, and, in addition, from *theresopolitana* in the absence of black from the wings and cephalic coxae and in the unmarked bases of the larger internal spines of the cephalic femora.

TYPE.—♀; Colonia Hansa, State of Santa Catharina, Brazil. [Hebard Collection, Type no. 221.]

Size small, form somewhat more robust than usual in the same sex in this genus. Head depressed trigonal in form, with the greatest width one and one-half times as great as the greatest depth of the same; occipital outline sinuato-truncate between the juxta-ocular sulci, juxta-ocular section (laterad of the sulci) moderately arcuato-bullate, sulci moderately impressed, straight, vertical for the greater portion of their length; face hardly concave; ocelli small, distinct, placed in a very much depressed triangle; facial scutellum strongly transverse, the greatest depth contained about two and one-half times in the greatest width, dorsal margin very broadly rounded obtuse-angulate mesad and faintly emarginate laterad, dorso-lateral angles nearly rectangulate, ventral margin shallowly arcuato-emarginate, surface faintly excavate; eyes well rounded in outline when seen from the cephalic aspect, in basal outline subovoid-pyriform, flattened caudad; antennae filiform, in length slightly shorter than the pronotum.

Pronotum moderately robust, greatest width of supra-coxal dilation contained three and one-third times in the greatest length; collar broad, margin regularly expanding from the strongly arcuate cephalic margin; supra-coxal dilation hardly differentiated from the collar, passing regularly by expansion from one to the other, broadly rounded and as evenly narrowing caudad to the shaft, the caudal half of which is subequal in width, caudal margin truncate mesad, well rounded laterad, entire lateral margins closely denticulate; median line on collar and cephalic section of shaft

²¹ Bollett. Mus. Zoolog. Anat. Comp. Torino, XXIX, no. 684, pp. 20, 21, (1914.)

as a fine sulcation; surface with numerous scattered fine asperities; transverse sulcus truncate mesad, arcuato-rectangulate laterad.

Tegmina surpassing the apex of the abdomen, in shape ovoid, one and four-fifths times as long as the pronotum, broad, the greatest width about two-fifths of the greatest length, marginal field opaque, discoidal and anal fields translucent; costal margin strongly and regularly arcuate, sutural margin largely straight, rounding to the rotundato-rectangulate apex; marginal field forming about one-third of the total tegminal width, oblique veins of the same quite irregular and much forked and fused; discoidal sectors five to six in number, oblique, equidistant, moderately sigmoid, transverse nervures moderately regular, irregular false sectors present toward the sutural margin; anal vein moderately arcuate, joining the sutural margin slightly proximad of the middle, anal field with axillary veins disposed similarly to the discoidal sectors; stigma distinct, close to the humeral trunk proximad of the middle, longitudinal, uncolored. Wings reaching to the tips of the tegmina, subhyaline translucent. Abdomen depressed, broad.

Supra-anal plate produced mesad into a linguiform process which is subequal to the proximal width of the plate; subgenital plate strongly compresso-rostrate distad, this section deep. Cephalic coxae faintly longer than the shaft of the pronotum, faintly arcuate distad, dorsal margin biseriate denticulate, the larger series six in number and recurved, the smaller ones minute and more numerous, the numbers between the larger denticulations variable, ventral margin sparsely serrulato-denticulate, the external margin similar but more closely armed, internal face with a few low tubercles parallel to the dorsal margin; cephalic femora faintly shorter than the pronotum in length, greatest depth contained three and one-half times in the greatest length, subcompressed, dorsal margin straight, ventro-external margin with four large spines, slightly longer proximad, lateral genicular lobe with a single rather short spine, ventro-internal margin with thirteen spines which are biseriate in length, the formulae (reading distad) being $1I1I1I1I1I1I$, discoidal spines four in number; cephalic tibiae (exclusive of the apical claw) subequal to one-half the femoral length, external margin armed with seven spines increasing in length distad, a considerable unarmed diastema present proximad, internal margin with eleven spines increasing in length distad, apical claw quite long, gently arcuate; cephalic metatarsi subequal to the remaining tarsal joints in length. Median and caudal limbs elongate, tibial carinations weak.

General color (undoubtedly discolored in drying and probably green in life) ochraceous-tawny. Head chestnut-brown (doubtless discolored). Tegmina yellowish-glaucous, mythro-green distad, the latter probably the natural color of the whole tegmen. Wings hyaline, faintly yellowish. Cephalic femoral and tibial spines weakly tipped with black or pitch black.

Length of body, 28.8 mm.;²² length of pronotum, 11.2; greatest width of supra-coxal expansion of pronotum, 3.4; length of tegmen, 20.5; greatest width of tegmen, 8.5; greatest width of marginal field of tegmen, 2.6; length of cephalic coxa, 8.8; length of cephalic femur, 10.5; length of caudal femur, 10.5; length of caudal tibia, 10.

The type is unique.

PHASMIDAE.

PYGIRHYNCHINAE.

Ceroys perfoliatus (Gray).

1835. *C[ladomorphus] perfoliatus* Gray, Synops. Spec. Ins. Fam. Phasm., p. 15. [Brazil.]

Rio de Janeiro. One female. [M. C. Z.]

This specimen is perfectly typical of the species, but shows some difference from the descriptions in having a second pair of tubercles on the mesonotum cephalad of the usual pair, the extra ones being developed as a strong spine (right side) or as a short conical tubercle (left).

The species has been previously recorded from this locality.

PSEUDOPHASMINAE.²³

Olcypoides tithonus (Gray).

1835. *P[hasma] tithonus* Gray, Synops. Phasm., p. 23. ["East Indies" (in error).]

Espirito Santo. One male. [Hebard Cln.]

²² Approximate, as the apex of the abdomen is twisted out of its normal plane.

²³ We have examined the unique type of *Phasma radiatum* Scudder (Proc. Bost. Soc. Nat. Hist., XXVII, p. 279, (1875)), and find that Redtenbacher (Insektf. Phasm., p. 105, (1906)), has properly placed this species in the genus *Stratoctes*, and has correctly interpreted the features of the species. Although the material examined by Redtenbacher was of the female sex and the type is a male, the characters assigned by him are all those of the type, except for relatively minor ones of the abdominal and limb coloration, and these may be sexual features. In the type the apex of the abdomen is solidly blackish, without any indication of the lateral ferruginous and the marginal greenish mentioned by Redtenbacher. The caudal tibiae in the type have the dorsal surface lined with ferruginous except proximad and distad, where the general blackish-color is found. Redtenbacher says the tibiae are uniformly fuscous-black, along with the tarsi. The caudal tarsi are pale ferruginous in the type, while those of the other limbs are as described by him.

Rio de Janeiro. November. Two males, two females. [U. S. N. M.]

This beautiful species has been reported from as far north as Cayenne, south to Santos, Brazil. The Espirito Santo male has the black areas on the antennae more extensive than in the other specimens.

***Paraphasma marginale* Redtenbacher.**

1906. *Paraphasma marginale* Redtenbacher, Die Insektenfam. Phasm., I, p. 115. [Santos, Minas Geraes, Rio de Janeiro, and Goyaz, Brazil; Paraguay.]

Piexe Boi, east of Pará, State of Pará. (H. B. Merrill.) November to December, 1907. One female. [A. N. S. P.]

Goyaz, State of Goyaz. Two males, three females. [Hebard Cln.]

Corumbá, State of Matto Grosso. April (highland). (H. H. Smith.) Three males, one female. [U. S. N. M.]

This species, or at least individuals which we feel compelled to refer to this species, exhibits a most extraordinary amount of variation in structure and, to a certain extent, in coloration. We have before us in addition to the specimens recorded above, individuals of both sex from Sapucay, Puerto Cantera and Alto Paraná, Paraguay, and Misiones, Argentina, most of which already have been reported. These specimens show appreciable variation in the relative width of the head, in the relative size of the ocelli, in the relative length of the tegmina, in the acuteness and degree of development of the tubercle of the tegmina and in the coloration of the wings and the limbs. The anterior field of the wings may have the coloration strongly bicolored, blackish and pea green, or the ground color pale with the vicinity of the longitudinal veins lined with fuscous; the posterior field of the wings may be unicolored infumate with the principal veins well lined, while in the other extreme the greater portion of the field is pale with the distal section and part of the margin infumate, the veins in the pale area non-infumate. The limbs may be blackish or mummy-brown. At first examination it appears that two distinct species are present, but when all the available material is examined it is found that there is only a partial correlation of these characters, one male from Sapucay, for instance, being in every other way characteristic of one of the extremes analyzed above, but having the broad head of the other extreme, while the Peixe Boi individual is in most of its features intermediate between the two types. The genitalic features of all of the specimens seem to be identical for the respective sexes.

Damasippus pulcher Redtenbacher.

1906. *D[amasippus] pulcher* Redtenbacher, Die Insektenfam. Phasm., I, p. 148. [Espirito Santo, Brazil.]

Espirito Santo. One female. [Hebard Cln.]

This specimen has the greenish-yellow on the head less clearly defined than the original description would lead one to suppose it is in the type, which was also a female. The caudal femora are also more clear greenish than "flavo-ferruginous" as described. In all the other features, however, the present individual is typical.

Prisopus horstokkii De Haan.

1842. *P[hasma] (Prisopus) horstokkii* De Haan, Verhandl. Natuurl. Geschied., Bijdragen Kenn. Orth., p. 113, pl. XII, fig. 1. ["Cape of Good Hope" (erroneous).]

Rio Verde, State of Goyaz. One female. [Hebard Cln.]

Gahan's recently described *P. fisheri*²⁴ is supposed to differ from *horstokkii* in the presence of triangular processes on the lateral sections of the metathorax, but our material, which fully agrees with the description and figure of *horstokkii*, possesses the same structures, yet differs from the description of *fisheri* in other features, as the color of the ventral surface of the body and of the membranous section of the wings. It is evident that either *horstokkii* possesses such appendages on the metathorax or the coloration given for certain areas, which are as a rule of fairly fixed character, varies in *fisheri*. We feel that the first explanation is more likely the correct one, in which conclusion we are strengthened by an examination of other material of the genus. The metathoracic processes are hidden from above in spread specimens and this may explain their oversight by previous workers.

This is the first Brazilian record of the species.

HETERONEMINAE.

Dyme straminea new species. (Plate X, figs. 10 and 11.)

This remarkably elongate and attenuate species can be distinguished by the excessively elongate and straw-like limbs, the slenderness of the body and the distinct medio-longitudinal fuscous line, which reaches from the inter-antennal region to the proximal portion of the abdomen, where it becomes obsolete. Of the species treated by Brunner the only one to which it appears at all allied is *D. incolumis*, from Vera Paz, Guatemala, and from the description of which it differs in the male (the only sex in hand) having the ventro-lateral margin of the penultimate (eighth) dorsal abdominal segment

²⁴ The Entomol., XLV, p. 54, fig., (1912).

straight, its angles rectangulate, instead of rounded with the angles obtuse, in the ultimate (ninth) dorsal abdominal segment of the same sex being two and one-half times as long as broad, instead of equally long and broad, and in the subgenital operculum falling distinctly short of the apex of the dorsal penultimate (eighth) segment, instead of reaching to the apex of the same as in *incolumis*.

TYPE.—♂; Goyaz, State of Goyaz, Brazil. [Hebard Collection, Type no. 471.]

Size moderately large: form very elongate and slender, bacilliform. Head with its length nearly one and one-half times that of the pronotum, the greatest width across the eyes contained twice in the length of the head, the caudal section of the head, i. e. that caudad of the eyes, subequal in width, slightly narrower than the width across the eyes: ocelli absent: eyes very short oval in basal outline, hardly prominent when seen from the dorsum: antennae not complete, in length certainly exceeding the head, pronotum and mesonotum as remaining portions show.

Pronotum no wider than the caudal section of the head, the length about twice the median width, the cephalic half faintly narrower than the caudal half; cephalic margin faintly arcuate emarginate, caudal margin very slightly arcuate convex; median transverse indentation pronounced, medio-longitudinal sulcus indicated cephalad. Mesonotum about three times as long as the combined length of the head and pronotum, slender, faintly widening caudad, the width elsewhere uniform, hardly greater than that of the head, strongly arcuate in transverse section, near each lateral margin with a continuous but low carina; caudal margin weakly arcuato-emarginate. Metanotum, including the median segment, four-fifths as long as the mesonotum, in general form and sculpture similar to the mesonotum: length of the median segment contained over three and one-half times in the length of the remainder of the metanotum; caudal margin of the median segment arcuato-emarginate. Meso- and metasternum with paired, prominent lateral carinae prominent throughout their length.

Abdomen slightly longer than the combined length of the head and thoracic segments, slender, faintly thickened and enlarged at the sutures between the segments; first to seventh joints distinctly elongate, the second to fourth joints slightly the longer; eighth dorsal segment slender, faintly shorter than the ninth segment, distinctly infolded ventro-distad; ninth dorsal abdominal segment three-fourths as long as the eighth dorsal abdominal segment,

slender, subcompressed, tectate, carinate dorsad, distal extremity broadly V-emarginate, the margin thickened, the ventral surface of the same supplied with a heavy covering of small, imbricate, adpressed denticulations, when seen from the side the segment has the lateral margins straight, the angles rectangulate; subgenital operculum moderately compressed, rostrate distad, reaching to the distal third of the eighth dorsal abdominal segment, ventral surface with a medio-longitudinal carina on distal section: cerci simple, slightly incurved, subequal in width, their length equal to about one-third that of the ninth dorsal abdominal segment, apex blunt, that section covered with recurved, chaetiform spinulations.

Limbs extremely slender, attenuate, multicarinate. Cephalic femora almost twice as long as the metanotum (including the median segment), cephalic flexure pronounced and slightly sigmoid when seen from the dorsum: cephalic tibiae surpassing the femoral length by about twice the length of the head: cephalic metatarsi nearly twice as long as the length of the remaining tarsal joints united. Median femora equal to the length of the metanotum and the first and half of the second abdominal segments, very slightly bowed: median tibiae surpassing the femoral length by about the length of the pronotum: median metatarsi hardly longer than the remainder of the median tarsal joints united. Caudal femora reaching to about the apex of the fifth dorsal abdominal segment, almost imperceptibly arcuate: caudal tibiae surpassing the femoral length by about the length of the head: caudal metatarsi slightly longer than the remaining tarsal joints united. Arolia relatively large in all tarsi.

General color ranging from primuline yellow on the thoracic segments to dull wax yellow on the abdomen, passing through buckthorn brown to cinnamon-brown on the limbs. Eyes buckthorn brown; antennae mar's brown proximad, passing into fuscous distad. Head with paired postocular lines of mummy brown; these are discontinuously indicated on the meso- and metanotum and the proximal abdominal segment. A medio-longitudinal line of blackish fuscous extends continuously from the inter-antennal region to the sixth abdominal segment, not strongly indicated distad of the second abdominal segment.

Length of body, 113.5 mm.; length of head, 5; length of pronotum, 3.6; length of mesonotum, 26; length of metanotum (including median segment), 21.2; length of median segment, 4.4; length of cephalic femur, 43.5; length of cephalic tibia, 54.2; length of median femur, 32; length of caudal femur, 37.

In addition to the type we have before us a paratypic male, differing from the type solely in being slightly smaller.

PHIBALOSOMINAE.

Bactridium grande new species. (Plate X, fig. 12.)

A very striking new species allied to *B. dentipes* Redtenbacher, *emortuale* (Saussure) and *gracile* (Serville), but differing from all in the much shorter operculum of the female, which does not exceed the apex of the body, and also from the individual species as follows: from *dentipes* in the larger size, in the presence of very decided teeth on the dorsal and ventro-external margins of the cephalic femora, in the relatively longer limbs and in the different spination of the median and caudal limbs; from *emortuale* in the relatively longer limbs and in the absence of lobes on the proximal section of the ventral margins of the median femora; and from the poorly defined *gracile* in the much greater size and the more spinose ventral carinae of the median femora.

TYPE.—♀; Santa Catharina, Brazil. [Hebard Collection, Type no. 401.]

Size very large; form elongate and as usual in the genus. Head nearly twice as long as the pronotum, subovate in outline when seen from the dorsum, the greatest width (across the eyes) contained one and one-half times in the length of the head; occiput subdeplanate, the caudal margin of the same weakly produced mesad and shallowly divided into two by a faint longitudinal impression, laterad of which production there is another faint impression in the same margin, the lateral margins of the occiput moderately and regularly converging caudad from the eyes; no apparent ocelli present; eyes moderately produced, subglobose; antennae missing except for the two proximal joints, the first of which is quite slender and elongate, depressed.

Pronotum moderately longitudinal, slightly broader caudad than cephalad; cephalic margin obtuse-angulate, strongly elevato-cingulate; lateral margins shallowly arcuate-emarginate cephalad, subparallel caudad; caudal margin arcuato-emarginate; cephalic intermarginal sulcus with a distinct median and paired lateral fossae, median transverse impression well marked mesad, obsolete laterad. Mesonotum about three times as long as the head and pronotum together, non-carinate. Metanotum (with median segment) about two-thirds as long as the mesonotum, of similar structure; median segment subequal in length to the metanotum proper.

Abdomen with all segments longitudinal, those from one to five regularly increasing from twice to four times as long as wide, sixth segment slightly more than three times as long as wide, seventh segment strongly compressed and three times as long as wide, eighth segment elongate quadrate, one and one-half times as long as wide, ninth segment (anal segment) with median length faintly more than greatest width, lateral margins moderately expanding caudad, caudal margin obtuse-angulate emarginate, median line finely sulcate; distal margin of the fourth dorsal segment transversely tuberculate mesad; supra-anal plate small, placed in the emargination of the anal segment, the margin arcuate; cerci slender, styliiform, acuminate, but faintly surpassing the lateral portions of the anal segment; sixth ventral segment produced ventrad into a distinct bidigitate process, which is subdepressed, with the processes well separated by a deep median incision and converging distad; subgenital operculum large and broad, but not surpassing the apex of the abdomen, the distal margin subobtusely rounded, the surface of distal portion wrinkled rugulose, a distinct median carina distad. Prosternum slightly transverse, trigonal.

Cephalic femora subequal in length to that of the head, pronotum and mesonotum combined, proximal flexure decided and strongly narrowed, dorso-internal margin strongly and ventro-external margin distinctly lamellate developed and serrato-dentate, dorso-external margin not elevated but with six spaced dentations, genicular lobes spiniform; cephalic tibiae damaged. Median femora subequal in length to the three proximal abdominal segments, very faintly bowed, dorso-internal margin with a high trigonal recurved spiniform lobe at the proximal third, distad of which there are from five to six similar but very much smaller tooth structures, dorso-external margin with four similar small structures on distal two-thirds, ventro-external margin with nineteen similar teeth, ventro-internal margin with eighteen to twenty teeth, ventro-median carina with five to six teeth; median tibiae slightly longer than the median femora, all the margins finely serrato-dentate, the dorso-internal mesad with an elongate but rather low lobe ending distad in a spine, all the carinae subcristate distad and there with several fine teeth; median metatarsi subequal in length to the remaining tarsal joints, dorsad with a low but distinct median carina. Caudal femora slightly longer than the median femora, of similar character, the margins armed with serrato-dentations of a minor grade, as follows—dorso-external, four to eleven; dorso-

internal, six to fifteen; ventro-external, twenty to twenty-six; ventro-internal, twenty-one to twenty-nine; ventro-median carina, ten to eleven, no lobes present on the margins; genicular lobes spinose, subdepressed; caudal tibiae faintly shorter than the four proximal abdominal segments, the margins armed and developed as on the median tibiae; caudal metatarsi slightly longer than the remaining tarsal joints, evenly cristato-lobate dorsad, the distal extremity of the lobe with three to six minute teeth.

General coloration pinkish-cinnamon to kaiser-brown (unquestionably green or a more uniform brownish in life), the femora, particularly the caudal pair, weakly washed with dark livid-purple, while the tibiae are in part weakly light fluorite-green to dull malachite-green, this probably a trace of the original coloration.

Length of body, 264.6 mm.; length of head, 12.5; length of pronotum, 7.3; length of mesonotum, 59.5; length of metanotum (including median segment), 40.3; length of median segment, 19.7; length of cephalic femur, 74; length of median femur, 56.5; length of median tibia, 64.3; length of caudal femur, 59.4; length of caudal tibia, 77.5; length of operculum, 24.2.

The type of this striking species is unique.

ACRIDIDAE.

PROSCOPINAE.

***Proscopia scabra* Klug.**

1820. *Proscopia scabra* Klug, in Nees ab Esenbeck, Horae Physicae Berolin., p. 19, pl. III, fig. 2. [Pará, Brazil.]

Upper Amazon. Two females. [M. C. Z.]

Brunner has recorded this species from "Provincia Alto Amazonas."

***Corynorhynchus hispidus* Klug.**

1820. *Proscopia hispida* Klug, in Nees ab Esenbeck, Horae Physicae Berolin., p. 20, pl. III, fig. 5. [Bahia, Brazil.]

Rio de Janeiro. One male, one female. [M. C. Z.]

The female specimen is somewhat smaller than the original measurements and is minus the caudal limbs, but it is clearly the opposite sex of the male now before us, and, when compared with a pair of *C. radula*, their close relationship to the latter species is very apparent. The specimens measure as follows:

Length of body.....	62.8 mm.	♂	♀	83.5 mm.
Length of head.....	9.3 "			14 "
Length of rostrum	1.8 "			4.4 "
Length of pronotum.....	17.3 "			19.5 "
Length of cephalic femur.....	10.3 "			11.1 "
Length of caudal femur	23 "			—
Length of caudal tibia.....	25 "			—

The form of the rostrum of the female is as figured by Brunner. The apex of the male abdomen is more short clavate than in the male of *radula*, the supra-anal plate is less sculptured and the sub-genital plate less produced, but the general form of the region is very similar.

The species was previously known only from Bahia.

ACRIDINAE (*Truxalinae* of authors).

Peruvia nigromarginata²⁵ (Scudder). (*Toxopterus minutus* of most authors.)

1875. *Machaerocera nigromarginata* Scudder. Proc. Boston Soc. Nat. Hist., XVII, p. 268. [Eastern slopes of the Peruvian Andes.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

This is the most eastern locality for the species. The previous record from Rio de Janeiro, made by Bruner,²⁶ refers to *P. ensicornis* (Rehn), which is an east coast form.

OMMEXECHINAE.

Spathalium klugii (Burmeister).

1838. *O[mmexechea] klugii* Burmeister, Handb. der Entom., II, abth. II, pt. I, p. 655. [Brazil.]

Goyaz, State of Goyaz. Three males, one female. [Hebard Cln.]

These specimens are inseparable from the female from Chapada, Matto Grosso, previously recorded by us, first as *cyanopterum*²⁷ and afterward correctly as *klugii*.²⁸

The species is known from Bahia, Santarem, Goyaz and Chapada, Brazil.

LOCUSTINAE (*Acridinae* of most authors).

Diedronotus laevipes (Stål).

1878. *T[rapidonotus] laevipes* Stål, Bihang till K. Svenska Vet.-Akad. Handl., V, no. 9, p. 20. [Sao Leopoldo, Brazil; Argentine Republic.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

This is the most northern as well as the extreme northeastern record for this species, which ranges south into northern Argentina and west to Santa Cruz de la Sierra, Bolivia (Bruner).

²⁵ For remarks on this name see Rehn, Trans. Amer. Entom. Soc., XLII, p. 280, (1916).

²⁶ Ann. Carneg. Mus., VIII, p. 23, (1911).

²⁷ Proc. U. S. Nat. Mus., XXXVI, p. 110, (1909).

²⁸ Proc. Acad. Nat. Sci. Phila., 1913, p. 329; footnote, (1913).

Zoniopoda fissicauda Bruner.

1906. *Zoniopoda fissicauda* Bruner, Proc. U. S. Nat. Mus., XXX, p. 653.
[Sapucay, Paraguay.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

This specimen, which is clearly the present species, has lost some of the brilliancy of its original coloration, as if it had been exposed to the continued action of a strong killing medium. It is slightly smaller than the measurements of the same sex given by Bruner. The two localities are the only ones from which the species is known.

Zoniopoda collaris Bruner.

1911. *Zoniopoda collaris* Bruner, Ann. Carneg. Mus., VIII, pp. 58, 60.
[Chapada, Matto Grosso, Brazil.]

Rio Verde, State of Goyaz. Three males. [Hebard Cln.]

These specimens agree with the original description of the unique type except that all the pale areas are slightly pinkish, which, however, we feel is not normal but due to chemical action of a killing medium. The species is known only from the two localities given above.

Diponthus bilineatus new species. (Plate X, figs. 13 and 15.)

A close ally of *D. crassus* Bruner (plate X, figs. 14 and 16), from northeastern Argentina and eastern Paraguay, differing in the slightly more elongate form (for the sex), in the slightly less declivent fastigium, in the proportionately more longitudinal pronotum, the more distinctly angulate caudal margin of the disk of the same, in the slightly more elevated medio-longitudinal section of the metazona, in the more oblique caudal margin of the lateral lobes of the pronotum, in the more elongate, narrower tegmina, in the more elongate male cerci, which surpass the apex of the supra-anal plate and have their distal extremity distinctly decurved, and in the coloration—the tegmina being non-reticulate but with the humeral trunk and the anal angle contrastingly lined with yellow on an olive-green ground, the caudal femora pinkish with a weaker medio-longitudinal line on the external face and with the caudal tibiae lacking the dark lining of *crassus* and reddish on the internal face, while the wing is more greenish hyaline, without the bluish wash seen in *crassus*.

TYPE—♂; Santa Catharina, Brazil. [Hebard Collection, Type no. 411.]

Size large (for the genus); form as in *D. crassus*; surface of the head, pronotum and pleura strongly and closely cribroso-punctate. Head with the vertex and fastigium considerably declivent, nar-

rowly rounding into the slightly retreating facial line; interspace between the eyes broad, but little narrower than the fastigium; fastigium distinctly broader than long, truncate cephalad, very shallowly and broadly excavate; frontal costa dorsad nearly as wide as the vertex interspace between the eyes, regularly narrowing ventrad until on the lower face, at the ventral third of the face, it is less than one-half the width at the fastigio-facial region, subobsolete in the vicinity of the clypeal suture, closely and deeply cribroso-punctate dorsad and ventrad, excavato-sulcate mesad, lateral margins well indicated; lateral facial carinae arcuate, converging to the clypeal base: eyes quite prominent, subovate in outline, faintly flattened ventrad, in depth about one and one-half times that of the infra-ocular portion of the genae: antennae about two and one-third times as long as the pronotal disk, thick, apex moderately acuminate.

Pronotum of moderate length, the greatest caudal width of the disk contained one and one-third times in the greatest dorsal length of the same; in section the prozona of disk is arcuate, the metazona low tectate; cephalic margin of disk broadly and shallowly angulato-emarginate mesad, caudal margin of disk regularly obtuse-angulate with the immediate angle narrowly truncate; prozona slightly shorter than the metazona; median carina obsolete, being but faintly indicated by strumositities between the punctures, lateral angles not at all indicated on the prozona, well marked but not carinate on the metazona; transverse sulci deeply impressed, the median one slightly weaker on the dorsum than the other two: lateral lobes with their greatest depth subequal to the greatest dorsal length of the same; ventro-cephalic angle of lobes obtusely rounded, ventral margin obliquely truncate cephalad, thence truncate to the broadly rounded ventro-caudal angle, caudal margin obliquely subconcave. Tegmina reaching to but not surpassing the apex of the abdomen; costal margin regularly broad arcuate, sutural margin nearly straight, apex rather narrow, obliquely subtruncate; principal longitudinal veins decided. Wings reaching to the apices of the tegmina. Prosternal spine distinctly compressed, directed moderately caudad, blunt; interspace between the mesosternal lobes faintly longitudinal, the internal face of the lobes arcuate; interspace between the metasternal lobes slightly transverse.

Furcula developed as broad, depressed, well separated, acute trigonal lobes, the external margin of which is straight, the internal concave: supra-anal plate escutcheon-shaped, slightly constricted proximad, of the same form found in *D. crassus*, a median rectangu-

late transverse strumosity placed at distal third, the adjacent portion of the lateral margins with a similar thickening, the section of the plate distad of these elevations deflected from the plane of the major portion of the plate; medio-longitudinal sulcus and its bounding carinae indicated on the proximal two-thirds of the plate, this area widening proximad: cerci straight, styliform, tapering, the extremity moderately decurved and incurved, apex acute: subgenital plate moderately full, faintly compressed dorso-proximad, free margin weakly and broadly emarginate mesad.

Cephalic and median femora moderately robust. Caudal femora equal to slightly more than one-half the body length, similar to the type found in *crassus* but more slender; caudal tibiae with ten spines on the external margin.

General color blackish-green, varied with shades of yellow-ocher, pinkish red and purplish. Head with a broad medio-longitudinal bar of vinaceous-rufous covering occiput, vertex, fastigium and face, except lateral margins of frontal costa, passing into the general color on the genae; eyes tawny-olive; antennae dark slate-purple, becoming dull brownish distad. Pronotum with a medio-longitudinal bar of ochraceous-tawny, sharply delimited from the general color, a narrow cephalic margin on the lateral lobes amber-yellow, almost all of the metazona on the lateral lobes and a lateral section of the dorsum of the same olive-ocher. Tegmina with the humeral trunk and vicinity of the anal vein lined with olive-yellow; veins of the general color on a greenish hyaline ground. Wings hyaline, faintly washed with greenish toward the costal margins, principal veins finely colored with the general shade. Abdomen tawny-olive with the dorsum, aside from a continuous, narrow, medio-longitudinal bar of the basic abdominal color, washed with blackish-green, this disappearing ventro-laterad; apex and internal margin of the furcula, strumosities of the supra-anal plate and apices of cerci black. Limbs largely vinaceous-russet; caudal femora with a median longitudinal line of blackish on proximal portion of the paginae, internal face pale carmine, with three transverse areas of blackish green—one premedian, one postmedian and the other covering the internal genicular area, external genicular area olive-citrine; caudal tibiae on the external face colored the same as the femora, on internal face pale carmine, external spines pale greenish tipped with black, internal spines black.

Length of body, 31 mm.; length of pronotum, 7; greatest caudal width of pronotal disk, 5.2; length of tegmen, 22; length of caudal femur, 16.8.

The type is unique.

***Chlorohippus roseipennis* Bruner.**

1911. *Chlorohippus roseipennis* Bruner, Ann. Carneg. Mus., VIII, p. 88.
[Chapada, Matto Grosso, Brazil.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

The present specimen agrees with Bruner's description of this interesting genus and species, except that the caudal margin of the pronotal disk is arcuate instead of subangulate as described, that the caudal tibiae have six instead of seven or eight spines on the external margin and the same tibiae are purplish-glaucous instead of oil-green as described. These differences appear to us to be individual, although future work may show the Goyaz and Chapada specimens to differ from one another in other unnoticed specific features. For the present, however, it is best to consider them as representing the same species.

***Coplocera erythrogastra* (Perty).**

1834. *Xiphicera erythrogastra* Perty, Delect. Anim. Articul. Brasil., p. 122, pl. XXIV, fig. 2. [Mountains of the Province of Minas Geraes, Brazil.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

It seems very probable that Marschall's *euceros* was based on the male sex of this species. The difference in antennal coloration mentioned by him may have been due to Perty's specimen having had the pale tips broken off.

***Episcopottetix sulcirostris* Rehn.**

1902. *Episcopottetix sulcirostris* Rehn, Trans. Amer. Entom. Soc., XXIX, p. 13. [Forest of San Juan, Mexico.²⁹]

Goyaz, State of Goyaz. Two females. [Hebard Cln.]

These specimens appear to us to represent the previously unknown female of this species. Certain features of difference from the male type are very apparent, but of these several are clearly sexual and the others are in all probability so. There exists, however, a possibility that the Goyaz females may be specifically distinct from the type of *sulcirostris*. The points of difference can be summarized as follows. The fastigium is shorter and broader than in the type, being distinctly shorter than the occiput, the dorsal surface not sulcate and distinctly lower than the level of the occiput, which latter is appreciably arcuate dorsad; the frontal costa is broader, less marked ventrad, with the sulcation distinct dorsad and subobsolete

²⁹ We feel that the correctness of this locality is open to question, as all the material seen since the original description came from South America. The type had been dried from alcohol and labelled a number of years ago, by whom we do not know.

ventrad; the fastigio-facial truncation is more rounded; antennae much shorter and less strongly ensiform proximad. The wings have the disk colored as in the male, but the anterior field is hyaline instead of largely blackish-brown as it is, continuously with the disk, in the male. The prosternal process, rather curiously, is unsymmetrical in both females, being transverse as in the male, but having the sinistral angle distinctly projecting in a moderately acute or sub-bulbous projection, far more developed than the corresponding dextral angle. The cerci of the female are very slender, tapering, nearly reaching the tip of the supra-anal plate; ovipositor valves elongate, the dorsal pair greatly produced, slightly more than twice as long as the cerci and nearly twice as long as the ventral valves, strongly compressed, sublamellate, unarmed, tips blunt. The fastigium and occiput bear a pair of fine blue-black lines, which gradually diverge caudad, these represented on the pronotum by paired diffuse mottlings of the same shade, which color the punctations of the regions they cover, the transverse sulci are lined with blue-black; the impressed lines on the face and some of the punctations on the same, blue-black; dorsum of the abdomen broadly nopal red; a narrow line on the ventral section of the external face of the caudal femora and the dorsal surface blue-black.

The present specimens measure (in millimeters) as follows:

Length of body	Length of head	Length of fastigium	Length of pronotum	Length of tegmen	Greatest width of tegmen	Length of caudal femur
44.5	9.8	4.6	5.6	37.5 (incomplete)	4.2	17
47	10.3	4.8	6	41.3	4.2	18

Bruner has reported a female of this species from South America without exact locality.³⁰

TETTIGONIIDAE.

PHANEROPTERINAE.

Hyperophora brasiliensis Brunner.

1878. *H[yperophora] brasiliensis* Brunner, Monogr. der Phaneropt., p. 126. [Brazil.]

Corumbá, State of Matto Grosso. March. (H. H. Smith; highland.) One female. [U. S. N. M.]

This specimen is somewhat smaller than the original measurements of the same sex, but otherwise it is not different as far as can be determined from the very brief original description. The antennae have well-separated pale annuli on a dark ground, the pale areas

³⁰ Biol. Cent.-Amer., Orth., II, p. 264; Ann. Carneg. Mus., VIII, p. 90.

more closely placed proximad, becoming more distant distad. The females previously recorded by us as this species from Sapucay, Paraguay,³¹ we find instead represent the previously unknown female of *cerviformis* Rehn.³² The female of *cerviformis* is a larger insect than *brasiliensis*, with a broader head as in the male, more elongate tegmina, shorter, more regularly tapering and less attenuate cerci, and much longer, more regularly arcuate ovipositor, which latter has the apex acute and the margins with fewer well-spaced teeth, which distad on the ventral margin are recurved. The surface of the ovipositor in *cerviformis* is less shagreenous than in *brasiliensis*. The selected allotype of *cerviformis* measures as follows: length of body (exclusive of ovipositor), 23.4 mm.; length of pronotum, 4.4; length of tegmen, 29.2; length of wing distad of tegmen, 7.5; length of caudal femur, 23.5; length of ovipositor, 9.

***Hyperophora peruviana* Brunner.³³**

1891. *Hyperophora peruviana* Brunner, Verhandl. k.-k. Zool.-botan. Gesell. Wien, XLI, p. 59. [Peru.]

Goyaz, State of Goyaz. Two females. [Hebard Cln.]

These specimens are both in the green phase and subequal in size to females from the province of Mendoza, Argentina, and appreciably smaller than Sapucay, Paraguay representatives of the same sex.

The species is now known to range from Peru east to Goyaz, Brazil, south to the Province of Mendoza, Corrientes and the territory of Misiones, Argentina.

***Uberaba brevicauda* Bruner.**

1915. *Uberaba brevicauda* Bruner, Ann. Carneg. Mus., IX, p. 303. [Chapada, Matto Grosso, Brazil.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

This specimen fully agrees with the description of this very interesting genus and species. The genus is known only from the two localities here mentioned.

³¹ PROC. ACAD. NAT. SCI. PHILA., 1907, p. 371, (1907).

³² *Ibid.*, p. 371, figs. 2 and 3.

³³ A revision of our previous records of *H. major* Brunner, and a careful examination of the few points given by Bruner for the separation of *H. major* and *H. peruviana* have convinced us that we have examined but a single specimen of the former species. This is the female from Embarcacion, Salta, Argentina, recorded by us as a member of the Argentina series of *major* (PROC. ACAD. NAT. SCI. PHILA., 1913, p. 360, (1913)). The remainder of the series there recorded, the series from Sapucay, Paraguay (*Ibid.*, 1907, p. 373, fig. 3, (1907)) and the male from Yuto, Argentina (*Ibid.*, 1915, p. 287, (1915)), all recorded as *major*, are instead *peruviana* as we now understand it. It is possible true *peruviana* may be different, but these specimens are in accord with the very insufficient original description. *Peruviana* as we understand it is a more elongate, more uniformly narrower winged species than *major*, with more elongate limbs.

***Ligocatinus sordidus* new species.** (Plate X, figs. 17 and 18.)

Allied to *L. olivaceus* (Brunner), from southeastern Brazil, Paraguay and northern Argentina, having much in common, in addition to the similar coloration of the two forms, but differing in the greater size, narrower fastigium of the vertex, narrower fastigium of the face, more distinctly longitudinal tegmina, which have a coarser reticulation than those of *olivaceus*, in the proportionately more slender and elongate limbs and in the decidedly more slender and elongate ovipositor. We do not know the male of the species, but are very certain it is not the female of *L. longicercatus* (Brunner), which was based on the male sex alone, as the size and coloration are quite different.

TYPE.—♀; Corumbá, State of Matto Grosso, Brazil. March. (H. H. Smith, highland.) [United States National Museum.]

Size medium, form more elongate and compressed than in *L. olivaceus*. Head with the occiput and interocular space full and strongly rounded, the latter moderately declivent to the fastigium, which is narrow, compressed, sulcate dorsad, with the distal extremity weakly inflated, nearly in contact with the acute-angulate but apically blunted fastigium of the face, the outline of the fastigium of the vertex, when seen from the side, being concave, the juncture with the vertex proper marked by a slight inflation: eyes large, quite prominent when seen from the dorsum, broad ovate in basal outline with a distinct ventro-cephalic angle, their depth subequal to that of the infra-ocular portion of the genae: antennae about twice as long as the body, proximal joint nearly half as wide as the eye. Pronotum not at all sellate, the dorsal line when seen from the side being straight, lateral angles of the disk not marked cephalad, weakly indicated caudad: disk with the cephalic margin truncate, caudal margin broadly and strongly arcuate; caudal width of the disk contained one and one-third times in the length of the same; lateral margins of the disk gently and regularly diverging caudad; surface of the disk with a median V-shaped impressed figure: lateral lobes of the pronotum with their greatest dorsal length slightly less than their greatest depth; cephalic margin of the lobes straight, ventro-cephalic angle roundly obtuse-angulate, ventral and caudal margins broadly and regularly arcuate to the distinct, rotundato-rectangulate humeral sinus. Tegmina elongate, the greatest width (at proximal two-fifths) contained about six times in the greatest length of the same; reticulations coarse and open compared with those of *L. olivaceus*; costal and sutural margins sub-

parallel proximad, the tegmen somewhat narrowed in distal half, apex narrowly rounded; humeral and discoidal veins non-attinent throughout, discoidal vein with one distinct distal ramus, median vein diverging slightly proximad of the middle of the tegmina, biramose. Wings surpassing the tips of the tegmina by about two-thirds of the dorsal length of the pronotum, apex of the closed wings sutural and rectangulate, the costal margin arcuate to the apex. Prosternum unarmed: meso- and meta-sternum strongly transverse, the former distinctly, the latter weakly emarginate mesad, caudo-lateral angles of both plates strongly rounded. Supra-anal plate²⁴ moderately acute trigonal, surface plane: cerci simple, short, tapering: ovipositor not strongly abbreviate and very deep as in *olivaceus*, but slightly bent at the base and faintly arcuate, the greatest depth not more than one-half the length and the form narrowed distad; dorsal margin of the ovipositor very faintly arcuate-concave, the extremity of the dorsal valves narrowly rounded; ventral margin of the ovipositor strongly arcuate throughout; all of the margins excepting the proximal third of the ventral margin with strong spiniform teeth, which are directed disto-dorsad on the dorsal margin and appreciably recurved on the ventral margin, those distad on the latter strongly recurved; surface of the ovipositor with three lines of serrato-dentations and mesad irregularly scattered, low, rounded tubercles: subgenital plate acute trigonal, compressed. Cephalic and median femora unarmed beneath; cephalic tibiae sulcate dorsad, but margins without spines excepting the caudal apical one; foramina open. Caudal femora four-fifths as long as the tegmina, strongly inflated proximad, distal half slender and the ventral margins there with not more than three spines, genicular lobes bispinose.

General color (apparently that of life) cinnamon, the tegmina with their base color warm fuscous, the venation and reticulations outlined in the general color proximad and in maroon distad; tibiae and the distal half of caudal femora washed with ox-blood red, the distal extremity of the caudal tibiae and the tarsi fuscous. Eyes brussels brown; antennae (aside from the proximal joint which is of the general color) amber-brown, multi-annulate with fuscous, which is the predominating color distad; face with the ventral margin of the antennal scrobes, the clypeal suture and a pair of short, arcuate vertical lines on the dorsal half, fuscous. Tegmina faintly greenish

²⁴ This is not clearly separated from the disto-dorsal abdominal segment, so the term is used in an analogous, not a strictly homologous, sense.

mesad on the costal margin. Exposed portion of the wings colored similarly to the distal portion of the tegmina. Abdomen with a broad, medio-longitudinal, dorsal bar of shining black, which includes the whole of the supra-anal plate; laterad of this bar the abdomen bears a pair of deep-chrome areas. Femoral and tibial spines tipped with black. Ovipositor teeth fuscous tipped.

Length of body (exclusive of ovipositor), 18.2 mm.; length of pronotum, 3.9; greatest (caudal) width of pronotal disk, 3.1; length of tegmen, 24.2; greatest width of tegmen, 4.1, length of caudal femur, 19.1; length of ovipositor, 5.

In addition to the type we have before us four paratypic females bearing the same data as the type, except that two were taken in April instead of March. The paratypes fully agree with the type in all essential features. In coloration they have some variation in the general tone, but the relative values remain the same. In one individual, which is not the palest of the lot, the facial markings are subobsolete.

Ligocatinus minutus new species (Plate X, figs. 19 and 20.)

A strikingly small member of the *olivaceus-longicercatus-sordidus* group of the genus, which in size is hardly more than two-thirds the bulk of the smallest of the previously known species. The genitalia are nearest in type to those of *longicercatus*, but the subgenital plate is hardly emarginate, while the caudal femora are unarmed beneath distad and the size, as already mentioned, is very much less. From *olivaceus* the species differs chiefly, aside from the smaller size, in the unspined ventral margins of the caudal femora, the form of the cerci and in the short styles of the subgenital plate. The species *sordidus* is known only from the female sex, but the size is quite different, the caudal femora are spined ventrad and the angle of the caudal margin of the lateral lobes of the pronotum is more decided and less rounded.

TYPE.—♂; Goyaz, State of Goyaz, Brazil. [Hebard Collection, Type no. 416.]

Size quite small: form as usual in the genus. Occiput gently rounded, regularly but strongly rounded to the fastigium, least width between the eyes slightly less than the depth of one of the eyes; fastigium compressed, weakly strumose proximad, distal portion faintly bulbous, sulcate dorsad, when seen from the lateral aspect rounded, largely in contact with the fastigium of the face; eyes moderately prominent, subreniform-ovate in basal outline, in depth subequal to the infra-ocular portion of the genae; antennae

incomplete. Pronotum with the general form much as in *sordidus* but with the disk broader, the greatest caudal width of same contained one and one-third times in the greatest length: lateral lobes with the general form more quadrate than in *sordidus*, the ventral margin being obliquely arcuato-truncate caudad, the ventro-caudal angle rotundato-rectangulate, humeral sinus as in *sordidus*. Tegmina but slightly exceeding the apices of the caudal femora, form similar, reticulations slightly coarse; discoidal vein with three distal rami, median vein diverging from the discoidal vein slightly proximad of the middle of the tegmina; stridulating field relatively simple, no distinct tympanum, stridulating vein no stronger than the other reticulations of the field. Wings surpassing the tegminal apices. Sternal plates of the types found in *L. sordidus*, but the meso- and metasternum are more decidedly transverse with the caudo-lateral angles more broadly rounded. Disto-dorsal abdominal segment arcuato-truncate dorso-mesad, with a shallow and very broad median emargination: supra-anal plate trigonal: cerci surpassing the subgenital plate, tapering, straight in the proximal four-fifths, the distal fifth slightly flattened and bent inward and dorsad, the immediate apex weakly uncinat, surface of the proximal portion of the cerci delicately tuberculate: subgenital plate narrowing distad, the distal margin truncate, styles very brief articulate nodes, ventral surface of the plate with a medio-longitudinal carina and converging paired ridges, which distad carry the styles. Caudal femora four-fifths as long as the tegmina, rather strongly inflated proximad, ventral margins unarmed, genicular lobes very weakly bispinose: caudal tibiae subequal to the femora in length.

General color chamois, becoming honey-yellow on the dorsum of the abdomen, the tegmina with their base color and also that of the wings mars-brown. Head with paired arcuate facial lines of mars-brown; eyes auburn; antennae (incomplete) hazel, sparsely annulate proximad with blackish. Tegmina with the stridulating field largely chamois, the sutural margin netted with wax-yellow, the humeral trunk, reticulations of the marginal and adjacent portion of discoidal field and costal margin primuline-yellow proximad, passing into bice-green distad. Abdomen with a broad medio-dorsal blackish-fuscon line; cerci tipped with same. Caudal tibiae pale absinth-green, becoming ochraceous-tawny.

Doubtless the original coloration of this insect was largely green or greenish, as traces of green are evident on the disk of the pronotum.

Length of body, 11.5 mm.; length of pronotum, 3.6, greatest dorsal (caudal) width of pronotal disk, 2.8, length of tegmen, 18.3; greatest (median) width of tegmen, 3.6; length of caudal femur, 14.8.

The type of this species is unique.

Ligocatinus spinatus (Brunner).

1878. *A[maura] spinata* Brunner, Monogr. der Phaneropt., p. 248, pl. V, figs. 74a and 74b. [Buenos Aires, Argentina.]

Corumbá, State of Matto Grosso. March (one), no date (four). One male, four females. [U. S. N. M.]

These specimens are indistinguishable from a pair from Rosario and a female from Buenos Aires, Argentina.

The species was recorded from Corumbá by Bruner.³⁵

Homotoicha fuscopunctata Caudell.

1906. *Homotoicha* (sic) *fuscopunctata* Caudell, Proc. U. S. Nat. Mus., XXX, p. 236. [Sapucay, Paraguay.]

Chapada, State of Matto Grosso. May (two), June (one), July (one), September (one), no date (three). (H. H. Smith.) Three males, five females. [U. S. N. M.]

These specimens have been compared with the male from Sapucay, Paraguay, previously recorded by us, ³⁶ a female from the same locality and another from the Misiones Territory, Argentine, and found to be identical. Bruner has recently recorded both sexes of the species from Chapada,³⁷ remarking that some little size variation was present in his series. The present representation shows the same feature, which, however, does not interfere with the recognition of the species, which is nearest in affinity to *H. laminata* Brunner. The form of the male cerci is very distinctive, particularly the structure of the apex.

The species is known only from the localities mentioned above.

Ceraia cornutoides Caudell.

1906. *Ceraia cornutoides* Caudell, Proc. U. S. Nat. Mus., XXX, p. 237. [Sapucay, Paraguay.]

Chapada, State of Matto Grosso. November. (H. H. Smith.) One female. [U. S. N. M.]

Corumbá, State of Matto Grosso. April. (H. H. Smith; high-land.) One female. [U. S. N. M.]

These specimens fully agree with males from Paraguay and a female from Misiones, Argentina. It is worthy of note, from the

³⁵ Ann. Carneg. Mus., IX, p. 309, (1915).

³⁶ PROC. ACAD. NAT. SCI. PHILA., 1907, p. 376, fig. 9, (1907).

³⁷ Ann. Carneg. Mus., IX, p. 309, (1915).

above females, that the subgenital plate of that sex is progressively deeper in its emargination as material from more northern localities is examined, this being shallowest in the Misiones individual and almost fissate in the Chapada specimen. The lateral angles of the plate are progressively produced as the incision deepens.

Bruner has recorded the species from both of the above localities and Puerto Suarez, Bolivia.

Scaphura nigra (Thunberg).

1824. *Gr[yllus] niger* Thunberg, Mém. Acad. Imp. Sci. St. Pétersb., IX, p. 415. [Brazil.]

Goyaz, State of Goyaz. Three females. [Hebard Cln.]

Rio Verde, State of Goyaz. Three females. [Hebard Cln.]

These specimens represent about four stages in the color variations of this unstable species, of which numerous color forms have been described as distinct species. One type is extremely close to Kirby's figure of *vigorsii*, except that the proximal section of the marginal field of the tegmina is as dark as the apex of the tegmina: another is similar but paler, with the pronotum largely rufous and the distal portion of the abdomen, particularly ventrad, similar—probably near to *kirbyi* Westwood; the third has the rufescence gone except from areas in the anal field, proximal section of the discoidal field and a proximo-median patch in the marginal field of the tegmina, while the apex of the tegmina is pale; the fourth form is nearly typical *nigra* or *chalybea*, with immaculate or nearly immaculate velvety black tegmina and strongly chalybeous abdomen.

Stilpnochlora marginella (Serville).

1839. *Phylloptera marginella* Serville, Hist. Nat. Ins., Orth., p. 405. ["Cape of Good Hope."]

Bonito, State of Pernambuco. (A. Koebele.) One male. [U. S. N. M.]

Theresopolis, State of Santa Catharina. One male. [M. C. Z.]

For comments on this species and its affinity to the other members of its species group, see the recent paper by the author on the subject.²⁸ Since the latter paper was written we have been able to examine the type of Scudder's *quadrata*, and find it to be identical with the material referred to that species by us. The type (male; Guayaquil, Ecuador; Museum of Comparative Zoology) has been badly damaged by insect pests at some time in the past, but its characters are clearly evident.

²⁸ Entom. News, XXVIII, pp. 108-110, (1917).

Anaulacomera³⁹ brevicauda Brunner.

1891. *Anaulacomera brevicauda* Brunner, Verhandl. k.-k. Zool.-botan. Gesell. Wien, XLI, p. 144. [Sao Paulo, Brazil.]

Chapada, State of Matto Grosso. July and August. (H. H. Smith.) Four males. [U. S. N. M.]

Corumbá, State of Matto Grosso. July. (H. H. Smith.) One male. [U. S. N. M.]

These specimens apparently represent the previously undescribed male of the species. As far as can be determined from the ambisexual characters given in the original description, our individuals are conspecific with the female described by Brunner. The stridulating field of the male tegmina is elongate and relatively narrow, bearing two very conspicuous, ivory-white, subcircular areas, surrounded and separated by a border of ox-blood red. The margin of the disto-dorsal abdominal segment is faintly arcuato-emarginate distad, while the supra-anal plate is of uncertain form, being buried by the flexed cerci; the latter are simple, tapering, deplanate distad, straight in the proximal two-thirds, then moderately arcuate inwards, the apex blunt; subgenital plate rather short, narrowing distad, with a distinct median carina, the distal margin truncate with the lateral angle produced into distinct, acute, substyliform processes. A representative specimen measures as follows: length of body, 14 mm.; length of pronotum, 4.3; length of tegmen, 25.5; greatest width of tegmen, 5.6; length of caudal femur, 17.5 .

The localities given above are apparently the only ones from which the species has been reported, Bruner having already recorded it from Chapada.⁴⁰

Anaulacomera bellator new species. (Plate X, figs. 21 and 22.)

Closely related to *A. intermedia* Brunner (plate X, fig. 23), with a male of which we have compared the new species, but differing in the more roundly deflected lateral lobes of the pronotum, the more narrowly rounded tegminal apices, somewhat longer limbs and more strongly divergent sections of the male cerci, these divided more proximad and the ventral section of which also carries on its dorsal surface a short supplementary spine.

³⁹ We find that the species described by us as *Hyperophrona signata* (Proc. Acad. Nat. Sci. Phila., 1907, p. 382, figs. 14, 15 and 16, (1907)), from Sapucay, Paraguay, is not a member of that genus, but instead an aberrant *Anaulacomera*, more nearly related to *A. brevicauda*. From the latter species *signata* differs in the proportionately broader tegmina, which are regularly elongate ovate, in the less slender limbs, the more sharply hooked cercal apices and the distinctly broader tympanal field of the male tegmen.

⁴⁰ Ann. Carneg. Mus., IX, p. 319, (1915).

TYPE.—♂; Rio de Janeiro, Brazil. November. (H. H. Smith.)
[United States National Museum.]

Size medium: form moderately compressed. Head with the occiput moderately arcuate in transverse section, not at all declivent cephalad; fastigium moderately compressed, faintly elevated and slightly enlarged distad, sulcate dorsad, the lateral margins of the dorsal surface faintly elevated proximad, cephalic face of the fastigium cuneate, weakly excavate, well separated from the acuminate frontal fastigium: palpi very elongate, extremely slender, the distal joint moderately arcuate distad; eyes prominent, semiglobose, in basal outline circular: antennae incomplete in the type, proximal joint large. Pronotum with the greatest caudal width of the disk contained one and two-thirds times in the length of the same, the surface of the disk moderately arcuate in transverse section cephalad deplanate caudad, lateral angles weakly indicated caudad; cephalic margin of disk faintly arcuate-emarginate, caudal margin moderately arcuate; an impressed figure, in the form of a broad Ψ , placed slightly caudad of the middle of the disk: lateral lobes of the pronotum slightly longer than deep; cephalic margin of lobes arcuate-sinuate, ventro-cephalic angle obtusely rounded, ventral margin, ventro-caudal angle and caudal margins broadly arcuate, regularly passing from the ventro-cephalic angle to the humeral sinus, the latter distinct but not deeply indicated, obtuse-angulate. Tegmina elongate lanceolate, surpassing the apex of the abdomen by more than twice the length of the head and pronotum combined; greatest width of tegmen contained four and one-half times in the length of the same, greatest width of the marginal field at the proximal third of the tegmen and there forming two-fifths of the entire tegminal width; costal margin in general very weakly arcuate, very briefly sharp arcuate proximad, distad regularly and decidedly arcuate to the relatively narrow, but well rounded apex; sutural margin nearly straight, moderately distad to the apex; marginal field irregularly areolate, with about six or seven oblique, irregular rami of the humeral vein, which are poorly dominant in the general areolation of the field; median vein diverging from the discoidal very faintly proximad of the middle of the tegmen, bifurcate, with the rami reaching the sutural margin; ulnar vein markedly undulate, without appreciable rami; discoidal field very closely and finely areolate, these slightly larger distad, in the proximal half of the area between the discoidal and ulnar veins are placed a series of six to seven low nodes in the reticulate areolation: stridulating field relatively nar-

row, moderately elongate, the margin very broadly obtuse-angulate at the apex of the stridulating vein, the latter thick, depressed, hardly arcuate. Wings surpassing the closed tegmina by about two-thirds the length of the pronotal disk. Prosternum with a broadly triangular figure: mesosternum with rounded obtuse-angulate lobes: metasternum with convergent, shallow, arcuate lobes. Abdomen but little compressed, the dorsal surface rounded tectate: disto-dorsal abdominal segment relatively short, subdepressed dorsad, faintly declivent distad; distal margin sinuato-truncate dorso-mesad, lateral margins markedly bisinuate: cerci relatively heavy, forked from the base, the rami strongly diverging, the dorsal one erect, moderately inbowed or faintly inbent, tapering, the apices acute spiniform, on the external and internal surfaces bearing three longitudinal grooves, separated by distinct, sharp carinulae; ventral ramus directed ventrad and slightly cephalad, when seen from the caudal aspect directed slightly inwards toward the median line of the body, the ramus relatively thick, weakly channelled on the internal face, the extremity somewhat thickened and rounded bulbous, with a blunt tooth on the internal face slightly proximad of the extremity; at about the middle of the ventral ramus, on the caudal face, there is present a slender, spiniform process, which is nearly straight and is directed caudo-mesad: subgenital plate relatively large, scoop-shaped, with a distinct, complete, median carina and short lateral carinae on the distal section of the plate, the latter carinae ending in very low, blunt tubercles, which form the lateral angles of the distal margin of the plate; distal margin of the plate not longer than two-thirds the length of the lateral margin of the plate, faintly angulate emarginate; lateral margins of the plate sinuato-arcuate. Cephalic femora more than five-sixths the length of the pronotal disk; cephalic tibiae one-third longer than the cephalic femora, very slender distad of the enlarged proximal section, auditory foramina relatively large, elliptical on both faces. Median limbs missing. Caudal femora but slightly shorter than the body, moderately slender, ventral margins spined distad, the external with seven, the internal with five spines both genicular lobes with a single spine; caudal tibiae surpassing the length of the femora by about half the length of the pronotal disk, all margins continuously spined, the dorsal ones more heavily so than the ventral ones.

General color ranging from sayal-brown on the head, pronotum and sides of the abdomen, to ochraceous-tawny on the dorsum of the abdomen, and cinnamon-buff, the latter broadly washed with

light cress-green, on the tegmina and exposed portions of the wings. The original color was probably more green than is now the case with the type specimen, but to what extent we cannot say, and the coloration described is that found in the present condition of the individual. Eyes cinnamon-brown, blotched with fuscous. Antennae, except for the proximal portion which is of the general color, clear kildare-green. Femora of the general color, tibiae weakly light cress-green.

Length of body, 21.8 mm.; length of pronotal disk, 5.3; greatest (caudal) width of pronotal disk, 3; length of tegmen, 29.3; greatest width of tegmen, 6.1; length of caudal femur, 19.8.

The type of this most interesting species is unique.

Anaulacomera libidinosa new species. (Plate X, figs. 24; Pl. XI, fig. 25.)

Apparently close to *A. chelata* Brunner, having with the older species a unique position in the genus by possessing an articulate appendage attached to the cercus of the male, but differing from *chelata* in the lateral lobes of the pronotum being longer than high, and in the articulate arm of the cercus being of a more highly specialized character, having the apex of the same blunt and depressed and the ventral surface with an arcuate compresso-lamellate expansion.

TYPE.—♂; Bonito, State of Pernambuco, Brazil. January 16, 1883. (A. Koebele.) [United States National Museum.]

Size medium: form distinctly compressed, deep: surface of limbs shining, of most of body dull. Head slightly broader across genae than caudad of the eyes; face faintly bullate, slightly compressed and the infra-antennal region impressed: palpi elongate, slender: eyes moderately prominent, faintly flattened subglobose when seen from the dorsum, slightly projecting cephalad, basal outline sub-circular: antennae slender, proximal joint relatively large. Pronotum with the disk narrow, its greatest caudal width contained about one and two-thirds times in the greatest length of the same, surface of the disk faintly arcuate transversely cephalad, deplanate caudad, lateral angles moderately indicated caudad, more rounded cephalad, surface of the disk with a fine medio-longitudinal sulcation, across which, slightly caudad of the middle of the disk, is placed an obtusely-angulate sulcation, which does not reach the lateral angles of the disk; surface of the cephalic portion of the disk slightly rugulose: cephalic margin of the disk truncate, caudal margin of the disk moderately arcuate: lateral lobes of the pronotum slightly longer than deep, nearly vertical; cephalic margin arcuato-emarginate,

ventro-cephalic angle rounded obtuse, ventral margin oblique subtruncate, ventro-caudal angle and caudal margin broadly and regularly arcuate, humeral sinus moderately decided, rounded rectangulate.

Tegmina about half again as long as the body, lanceolate, the greatest width contained slightly more than three and two-thirds times in the length of the same, the marginal field at the proximal third of the tegmen forming two-fifths of the entire tegminal width: costal margin well arcuate proximad and distad, flattened mesad, apex moderately narrowed but well rounded, sutural margin gently arcuate: marginal field with numerous but coarse areolations, which are deeply etched, among which there stands out above seven poorly defined oblique rami of the humeral vein; median vein diverging slightly distad of the middle of the tegmen, this bifurcate with the rami reaching the sutural margin shortly proximad of the apex, these and the ulnar vein much fractured and in consequence somewhat zig-zag in their direction, the areolations of the discoidal field in general, but particularly proximad, finer than those of the marginal field: stridulating field relatively small, the margin rounded obtuse-angulate at the apex of the stridulating vein, the latter slightly oblique, gently arcuate, distinctly depressed, thickened. Wings with the normally exposed portion projecting distad of the tegmina a distance equal to the length of the pronotal disk, the form of the apex narrowly rounded acute.

Prosternum with a broadly V-shaped carinate elevation: mesosternal lobes very small, rounded rectangulate, convergent: metasternal lobes similar to the mesosternal lobes but slightly larger. Disto-dorsal abdominal segment moderately cucullate, the margin arcuate-emarginate laterad around the cercal bases, the distal margin proper (mesad) shallowly arcuate-emarginate: cerci with the main (ventral) shaft about two-thirds as long as the disk of the pronotum, weakly compressed, gently falciform, tapering in proximal half, subequal in distal half where the width is little more than half that at the base, the apex with an unguiculate spine; dorsal articulate section of the cercus about half again as long as the ventral portion, straight, at the middle on the ventral surface there is developed a low but distinct lamellation, which is regularly arcuate proximad, oblique subtruncate distad, the angle narrowly rounded, the general form of this lamellation strongly suggesting the femoral lobes of certain mantids of the subfamilies Vatinae and Empusinae, the distal section of this arm of the cercus

is depressed and when seen from the dorsum spatulate: subgenital plate broad, slightly scoop-shaped, regularly narrowing distad, distal margin of the plate so damaged that its true form cannot be determined, the styles also being missing, but the latter were in all probability well developed, as tubular sockets in which they were placed are indicated in the remaining section of the distal portion of the plate.

Cephalic femora subequal to the disk of the pronotum in length; cephalic tibiae surpassing the femora in length by about one-fourth of the femoral length, very slender except in the proximal fourth, auditory tympani elliptical. Median femora half again as long as the pronotal disk; median tibiae surpassing the femoral length by about that of the distal tarsal joint. Caudal femora nearly three-fifths as long as the tegmina, moderately inflated proximad, slender distad, moderately compressed proximad, ventral margins armed with three to four (external) and two (internal) spines; caudal tibiae one and one-fifth times as long as the femora, compressed, deeper proximad than distad, armed on the dorsal margins with distinct spines, those of the internal margin more numerous than those of the external and differing from those on the latter margin in being erect and not diverging, between the spines is present a continuous, distinct and deep sulcus, ventral margins with relatively few spines, these mainly distad.

Original coloration of the specimen destroyed by immersion at some time in a liquid preservative. Present color wood-brown, the tegmina verona brown.

Length of body, 17.2 mm.; length of pronotum, 4.9; greatest (caudal) width of the pronotal disk, 2.9; length of tegmen, 27; greatest width of tegmen, 6.8; length of caudal femur, 21.2; length of caudal tibia, 18.5.

The type of this species is unique.

***Anaulacomera sulcata* Brunner.**

1878. *A[naulacomera] sulcata* Brunner, Monogr. der Phaneropt., pp. 279, 289. [Brazil; Peru.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

This specimen fully agrees with the original description and is inseparable from an individual of the same sex from Rio de Janeiro, in the collection of the Academy of Natural Sciences of Philadelphia, which was determined as *sulcata* by Saussure, from whom it was received. The species has been questionably recorded from Rio de Janeiro by Bruner.

***Grammadera rostrata* Rehn.**

1907. *Grammadera rostrata* Rehn, Proc. Acad. Nat. Sci. Phila., 1907, p. 378, figs. 10 and 11. [Sapucay, Paraguay.]

Corumbá, State of Matto Grosso. March. (H. H. Smith; lowland.) One female. [U. S. N. M.]

This specimen has been compared with the type and found to be inseparable. The size is very faintly smaller, and the ovipositor is faintly more arcuate proximad on the ventral margin, but otherwise the two are identical.

Corumbá and Sapucay are the only localities known for the species.

***Grammadera chapadensis* Bruner.**

1915. *Grammadera chapadensis* Bruner, Ann. Carneg. Mus., IX, p. 321. [Chapada, Matto Grosso, Brazil.]

Chapada, State of Matto Grosso. November. (H. H. Smith.) Two males, two females. [U. S. N. M.]

Goyaz, State of Goyaz. Four females. [Hebard Cln.]

These specimens fully agree with the description of *chapadensis*, which is certainly close to *albida* Bruner. Just how it differs from the older species is not at all clear, as the form of the supra-anal plate of the male, which is said in the original description of *chapadensis* to be the chief characteristic of the species, shows no differences which would not be covered by Bruner's brief description of this area in *albida*.

The material from Sapucay, Paraguay and Misiones, Argentina which we had previously referred to *albida*,⁴¹ we now know does not belong to that species, but instead represents *G. steinbachi* Bruner,⁴² a species which at the time of our references was undescribed. In consequence we do not know *albida* Bruner, to which, however, *chapadensis* is very close.

The localities given above are the only ones known for the species.

***Phylloptera*⁴³ *quinque-maculata* Bruner.**

1915. *Phylloptera quinque-maculata* Bruner, Ann. Carneg. Mus., IX, p. 325. [Chapada, Matto Grosso, Brazil.]

Chapada, State of Matto Grosso. July and October. (H. H. Smith; campo [October].) Two males, one female. [U. S. N. M.]

These specimens are perfectly typical of Bruner's species. One male is more brownish than the other individuals, while in all the dorso-caudal section of the pronotal disk is strongly colored.

⁴¹ PROC. ACAD. NAT. SCI. PHILA., 1907, p. 377, [Sapucay, Paraguay]; *Ibid.*, 1913, p. 371, [Misiones, Argentina]; *Ibid.*, 1915, p. 287, [Misiones, Argentina].

⁴² Ann. Carneg. Mus., IX, p. 322. [Puerto Suarez, Bolivia.]

⁴³ At this writing we have before us the unique female type of *Phylloptera tripunctata* Scudder (Proc. Boston Soc. Nat. Hist.; XVII, p. 261, (1875)), described

Phylloptera phyllopteroides (Brunner).

1878. *P[arableta] phyllopteroides* Brunner, Monogr. der Phaneropt., p. 254. [Brazil.]

Goyaz, State of Goyaz. One male, two females. [Hebard Cln.]

This is apparently the first record of the species with exact data.

Phylloptera tenella new species. (Plate XI, figs. 26, 27 and 28.)

A close relative of *P. alliedea* Caudell, from Paraguay,⁴ and *P. cognata* Rehn, described below, but particularly close in its relationship to the former. From *alliedea* the present species differs in its considerably smaller size, more robust proximal portion of the caudal femora and the more bent, shorter and blunter ovipositor. The form of the latter strongly approaches that of the ovipositor of *P. cognata*, but in proportions it would hold an intermediate position, as the apex is more acute and the disto-dorsal section of the margin is by no means as coarsely spined as in *cognata*.

TYPE.—♀; Corumbá, State of Matto Grosso, Brazil. March. (H. H. Smith; highland.) [United States National Museum.]

Size medium: form compressed. Head with the fastigium narrow, acuminate, sulcate, moderately declivent, hardly in contact with the fastigium of the face, the latter moderately acuminate: palpi elongate, slender, the distal joint arcuate: eyes not prominent, faintly compressed, slightly projecting cephalad, in basal outline slightly ovate. Pronotum with the disk deplanate, relatively broad, the greatest caudal width contained one and one-fifth times in the greatest length of the same; cephalic margin of the disk concave with a faint angulate tendency, caudal margin of the disk strongly arcuate; surface of the disk with a distinct but narrow medio-longitudinal sulcus, a median figure forming with the sulcus the letter Ψ; lateral angles distinct, rectangulate, subcarinate: lateral lobes slightly deeper than long; cephalic margin of the lobes weakly concave, ventro-cephalic angle moderately rounded, ventral margin

from the "Eastern slopes of the Peruvian Andes." Brunner, in 1878 (Monogr. der Phaneropt., p. 314), suggested the possibility of the species being the same as his there described *P. serva*, while, in 1896, Scudder (Proc. Boston Soc. Nat. Hist., XXVII, p. 213) stated it appeared to be a *Homotoicha*. Kirby in his catalogue (Synon. Catal. Orth., II, p. 450, (1906)), placed *tripunctata* in *Parascudderia*. As a matter of fact the species is a *Phylloptera*, rather aberrant in certain features it is true, but it is the same as either *P. nigro-auriculata* or *breviramulosa* Brunner (Verhand. k.-k. Zool.-botan. Gesell. Wien, XLI, p. 162, (1891)), from the Upper Amazons. It agrees in structure and coloration very fully with *breviramulosa*, but in addition has the tegminal margins and cephalic tibiae colored as in *nigro-annulata*. The safer course appears to us to be the synonymizing of *breviramulosa* under *tripunctata*. The type is in bad condition, having been dried from alcohol.

⁴ Proc. U. S. Nat. Mus., XXX, p. 238, (1906).

broadly arcuate, ventro-caudal angle not indicated, the ventral margin passing regularly into the arcuate caudal margin, humeral sinus well indicated, rounded obtuse-angulate.

Tegmina surpassing the apex of the abdomen by the greater portion of the length of the caudal femora, its length slightly more than six times that of the disk of the pronotum, its greatest width contained two and four-fifths times in the greatest length of the same: costal margin regularly and rather strongly arcuate, sutural margin similarly arcuate, apex broadly rounded acute: marginal field at its widest point forming about two-fifths of the entire tegminal width at that point: median vein diverging at two-fifths of the tegminal length from the base, bifurcate, the arms reaching the sutural margin very shortly before the apex; ulnar vein with two distinct rami; transverse nervures of the discoidal field relatively few, rather regularly placed, those distad slightly oblique, the "dead" spots placed one on each of the ulnar rami close to the main vein, the third covers the short transverse nervures connecting the ulnar vein and the proximal fork of the median vein: anal field narrow, clongate. Wings but slightly projecting distad of the closed tegmina, the apex moderately acute when closed, when the wing is expanded the apex is rotundate rectangulate.

Mesosternal lobes relatively small, acute: metasternal lobes rectangulate, arcuate laterad. Abdomen distinctly compressed, moderately carinate dorsad, aside from the two dorsal segments: disto-dorsal abdominal segment short, weakly sulcate medio-longitudinally, the margin rather briefly sinuato-emarginate on each side of the sulcus: supra-anal plate trigonal, briefly and shallowly sulcate proximad: cerci tapering, falciform, relatively thick proximad, the extremity slender: ovipositor one and two-fifths times as long as the disk of the pronotum, strongly compressed, deep, regularly falcate, the dorsal margin serrulate in the greater portion of its length, the denticulations regularly increasing in size distad, ventral margin with recurved denticulations for a short distance distad, apex of the two valves together moderately acute; surface of ovipositor with depressed shagreenous teeth: subgenital plate trigonal, deeply sulcate medio-longitudinally, this bounded laterad by converging, elevated, rounded ridges.

Cephalic femora very slightly longer than the pronotal disk, ventro-internal margin armed distad with two to three spines; cephalic tibiae with the auditory foramina elongate elliptical. Caudal femora about three-fifths as long as the tegmen, moderately

inflated proximad, appreciably compressed, ventro-external margin with six spines, ventro-internal margin with five to eight spines, genicular lobes bluntly bispinose: caudal tibiae faintly longer than the femora, subcompressed, particularly proximad, the dorsal margins sublamellate carinate, multispinose, the ventral margins less thickly spined, dorsal surface moderately deplanate impressed.

ALLOTYPE.—♂; Same data as type. [United States National Museum.]

Differing from the above description of the type in the following features. Stridulating field of the tegmina with its margin oblique arcuate to the apex of the stridulating vein, there rounded and distad very faintly arcuate the remainder of its length; stridulating vein thick, strongly depressed, in fact flattened, in the greater portion of its length transverse, narrowing distad, the distal margin of the vein with a distinct cingulate ridge. Disto-dorsal abdominal segment with the sinuate-emarginate character of the margin much less decided than in the female, yet appreciable: cerci strongly falcate dorso-mesad, slightly thickened proximad, elsewhere uniform in thickness, the extremity not acuminate, armed with two low, very blunt teeth: subgenital plate with the lateral margins regularly narrowing distad, the distal extremity very narrowly arcuate-emarginate, the bases of the styles developed as short projections on each side of the distal emargination, these projections represented and continued over the plate for some distance by slightly diverging rounded ridges; styles short, their length subequal to the distance between their bases, simple. Caudal femora with the ventro-external margin bearing four to five spines; ventro-internal margin with four to five spines.

General color honey yellow to clay color (doubtless discolored), the distal three-fifths or all of the tegmina course-green, the venation in the green sections lined with light hellebore-green, the "dead" area mummy-brown. Normally exposed portion of the wings colored similarly to the tegmina. Eyes buckthorn-brown. Limbs proximad of the general color, passing on the distal section of the femora and the tibiae to course- and biscay-greens, these more decided on the caudal limbs.

Measurements (in millimeters.)

	Length of body	Length of pro- notum	Greatest (caudal) width of pronotal disk	Length of tegmen	Greatest width of tegmen	Length of caudal femur	Length of ovi- positor
♂, allotype.....	20	4	3.3	26	9.2	16.1	—
♀, type	21.5	4.1	3.6	28.3	10.2	18.3	6

In addition to the type and allotype we have before us two male and one female paratypes which bear the same data as the type, except that all three of them were taken in the month of April. These specimens show no noteworthy variation from the above descriptions, except in furnishing data on the variability of femoral spine formulae. The cephalic femora have on the internal face distad from two to four spines, while the caudal femora are armed on the external margin with from four to six (generally five) spines, the internal with from four to eight spines.

Phylloptera cognata new species. (Plate XI, figs. 29, 30 and 31.)

Closely related to *P. alliedea* Caudell, from Sapucay, Paraguay,⁴⁵ agreeing in the sulcation of the cephalic femora, the form of the sternal lobes and the general form, but differing in the more elongate basal outline of the eyes, the axis of which is more oblique dorso-caudad, the more compressed fastigium of the face, the proportionately narrower tegmina and the shorter, much broader (proportionately) and distinctly bent ovipositor, the apex of which is dorsad and sharply narrowed and on the distal portion of the dorsal margin is strongly dentate. From the above described *tenella*, *cognata* can be separated readily by its larger size, the shape of the eyes and the stouter and more abbreviate ovipositor. The male of the species is unknown.

TYPE.—♀; Chapada, State of Matto Grosso, Brazil. August. (H. H. Smith.) [United States National Museum.]

Size medium: form compressed: surface dull, mat, the tegmina and exposed portion of the wings coriaceous. Head in general form similar to that of *tenella*: fastigium faintly longer and more regularly narrowing than in *tenella*; fastigium of the face as in *tenella*, median ocellus large: face bullate to the same degree and laterally compressed in similar fashion to that of *tenella*: palpi equally slender but slightly shorter than in *tenella*: eyes in basal outline distinctly ovate, the axis oblique: antennae reaching at least as far as the tips of the tegmina.

Pronotum as in *tenella* except that the ventro-cephalic angle of the margin of the lateral lobes is more obtuse and less rounded. Tegmina very similar to those of *tenella*, but the apex is slightly more sharply rounded. Sternal lobes of the type found in *tenella*, but they are individually slightly more longitudinal. Apex of the abdomen as in *tenella*, with the following differences: oviposi-

⁴⁵ Proc. U. S. Nat. Mus., XXX, p. 238, (1906).

tor subequal in length to the disk of the pronotum, strongly compressed, moderately deep, bent dorsad very close to the base, apex of the two valves together broader and blunter than in *tenella*, the dorsal margin serrulate distad, the ventral margin recurved denticulate distad.

Cephalic femora armed on the ventro-internal margin with four spines distad. Caudal femora about four-sevenths as long as the tegmen, general form as in *tenella*, ventro-external margin with six to nine spines, ventro-internal margin with four to six spines: caudal tibiae as in *tenella*.

General color of the body and limbs antimony yellow to ochraceous-buff, darkening on the ventral surface of the abdomen to tawny, tegmina, exposed portion of the wings and to a certain extent the dorsum of the pronotum, cource-green, the veins frequently, and to a variable degree, lined with light hellebore-green, the "dead" spots mummy brown and variable in size, occasionally but two being present. Eyes buckthorn-brown. Tibiae cource-green, the extremities of the caudal femora weakly of the same color. In life the body coloration was in all probability green or greenish, that of the tibiae probably being a remnant of the natural color.

Length of body, 19 mm.; length of pronotum, 4.5; greatest (caudal) width of pronotal disk, 3.9; length of tegmen, 32; greatest width of tegmen, 10.9; length of caudal femur, 18.5; length of ovipositor, 5.

In addition to the type we have before us two paratypic females, which bear the same data as the type, except that one was taken in the month of July instead of August. These specimens show no noteworthy differences from the type. One of the specimens has lost the cephalic femora and the other has but a single one; in this latter the femur has but a single spine on the ventro-cephalic margin. The ventro-external margin of the caudal femora has the spines seven or eight in number, of the ventro-internal margin six to eight in number. These figures make the known variation in the formulae of these margins for the species, six to nine and four to eight respectively.

Phylloptera ovalifolia Burmeister.

1838. *Phylloptera* *ovalifolia* Burmeister, Handb. der Entom., II, Abth II, pt. I. p. 693. [South America.]

Rio de Janeiro, State of Rio de Janeiro. November. One male. [U. S. N. M.]

This species previously has been recorded from Rio de Janeiro, Theresopolis and Santa Catharina, Brazil.

Phylloptera spinulosa Brunner.

1878. *Ph[ylloptera] spinulosa* Brunner, Monogr. der Phaneropt., p. 314. [Ypanema, State of Sao Paulo, Brazil.]

Rio Verde, State of Goyaz. One female. [Hebard Cln.]

Goyaz, State of Goyaz. One male. [Hebard Cln.]

Corumbá, State of Matto Grosso. March and April. (H. H. Smith; highland.) Three females. [U. S. N. M.]

These specimens show a great amount of size variation, which appears to have some geographic correlation.

The Corumbá specimens are of a uniformly medium size, while the Rio Verde female is quite large, and the Goyaz male the smallest individual of the species we have seen, much smaller than a Sapucay male, the only other individual of that sex at hand. The tegmina of one Corumbá individual are unmarked, of another with a single small ocellar spot on the ulnar vein at the base of its first ramus, and the third with a relative large greenish-white ocellar spot in the same position. The Rio Verde female has no tegminal spots, and the Goyaz male is similar in this respect to the second Corumbá individual mentioned above. There is considerable variation in the relative width of the tegmina, which is apparently individual in character.

The species is now known to range from the State of Goyaz west to at least Corumbá, south to Sapucay, Paraguay and the Misiones, Argentina.

Pycnopalpa bicordata (Serville).

1825. *L[ocusta] bicordata* Serville, Encycl. Méthod., Ins., X, p. 343. [Brazil.]

Rio de Janeiro, State of Rio de Janeiro. November and December. (H. H. Smith.) Two males. [U. S. N. M.]

These specimens show some difference in size, but are clearly identical. Bruner has recorded the species from this locality.

Pycnopalpa rubiginosa (Brunner).

1915. *Topana rubiginosa* Bruner, Ann. Carneg. Mus., IX, p. 330. [Chapada, Matto Grosso, Brazil.]

Chapada, State of Matto Grosso. July. (H. H. Smith.) One male. [U. S. N. M.]

This specimen fully agrees with the original description except for its faintly smaller size. We feel that Bruner was not correct in placing this species in *Topana*, as a careful comparison of it with the genotypes of *Topana* and *Pycnopalpa* shows more features of agreement with the latter than with the former. The cingulate disk of the pronotum, the form of the palpi, the number of spines

on the ventro-cephalic margin of the cephalic femora, the form of the stridulating field of the male tegmina and the color distribution at the base of the tegmina are as in *Pycnopalpa*, while the tegminal venation and the non-erose character of the tegmina are as in *Topana*. As the majority of the striking features accord with *Pycnopalpa* this association is clearly the more justifiable course to pursue, although *rubiginosa* is a definite proof of the common origin of the two genera.

***Topana cincticornis* (Stål).**

1873. *Ph[ylloptera] cincticornis* Stål, Ofv. K. Vetensk.-Akad. Förhandl., XXX, p. 43. [Brazil.]

Chapada, State of Matto Grosso. April, July and August. (H. H. Smith; one labelled "highland".) One male, four females. [U. S. N. M.]

Brunner⁴⁶ has recorded the species from this locality. These specimens agree with Stål's description, but are somewhat smaller than the measurements given for the species by Brunner. The species has been definitely recorded from Rio de Janeiro, Nova Friburgo, Matto Grosso and Chapada, Brazil, and Luque, Paraguay, as well as general "Brazil" and "Paraguay" records.

***Diplophyllus ensifolius* Saussure.**

1859. *Ph[ylloptera] (Diplophyllus) ensifolia* Saussure, *Révue et Magasin de Zoologie*, 2e sér., XI, p. 202. [Bahia, Brazil.]

Corumbá, State of Matto Grosso. March. (H. H. Smith; highland.) One female. [U. S. N. M.]

This specimen agrees with the two previous descriptions (Saussure and Brunner), which were based on the male sex, but has the tegmina shorter (33 mm. instead of 39) and narrower (10 instead of 11) than Brunner's measurements of the same. When compared with a female of *D. punctatus* (Stål), from Montserrat, West Indies, *ensifolius* is seen to be a more slender insect, with less globose eyes, more regularly lanceolate and less angulate tegmina, and much more elongate, narrower and regularly arcuate ovipositor, which has the distal third of its dorsal margin crenulato-serrate and the same portion of the ventral margin recurved serrato-dentate. The length of the ovipositor is 9.6 mm.; the median depth of the same, 1.9.

⁴⁶ Ann. Carneg. Mus., IX, p. 330, (1915).

Microcentrum lanceolatum (Burmeister).

1838. *Ph[yloptera] lanceolata* Burmeister, Handb. der Entom., II. abth. II, pt. 1, p. 692. [Brazil.]

Rio de Janeiro, State of Rio de Janeiro. November. (H. H. Smith.) Two males. [U. S. N. M.]

The present widely distributed species has been recorded from this locality by Brunner and Bruner.

Lobophyllus reversus new species. (Plate XI, figs. 32 and 33.)

A striking species, differing chiefly from *L. legumen* Saussure, from "Brazil," the genotype and only previously known species, in the more subequal dorsum of the pronotum, the much more ample tegmina, the distal portion of which is much wider, in the transverse veins of the marginal field of the tegmina being directed proximad, in the ramus of the median vein being proximad extremely close to the median vein, in the more regular disposition and correlation of the rami of the median and ulnar veins and in the caudal tibiae slightly surpassing instead of being shorter than the femora. The ovipositor of the new species is quite different from that of *legumen*, being proportionately shorter and broader with a rotundato-truncate apex and the margin of the same section denticulate.

TYPE.—♀; Goyaz, State of Goyaz, Brazil. [Hebard Collection, Type no. 473.]

Size large: form moderately compressed: surface unpolished, tegmina and exposed portions of wings coriaceous, with a faint gloss. Head with its greatest width slightly greater than the depth from the occipital margin to the clypeal suture: occiput bullato-arcuate transversely, regularly arcuato-declivent from the caudal portion of the occiput to the fastigial suture: fastigium of the vertex very broad, faintly broader than the greatest dimension of the eye, not at all elevated above the general level of the head, broadly in contact with the equally wide and similarly constructed fastigium of the face, the inter-fastigial suture straight: surface of the fastigia and vicinity cribroso-punctulate, the occiput and genae with scattered indications of the same: eyes little prominent, relatively small, in basal outline subcircular, with a slight flattening cephalad: antennae not reaching to the apex of the abdomen, aside from the two proximal joints very slender.

Pronotum with the length of the disk about one and one-fourth times the greatest width of the head, the greatest (caudal) width of the disk contained one and one-fourth times in the length of the same; disk nearly subequal in width; the lateral margins faintly diverging, regularly, caudad, the cephalic width equal to about nine-tenths the caudal width; cephalic margin of the disk arcuate--

emarginate with a faint median tooth, caudal margin of the disk strongly arcuate with a weak, shallow median emargination; lateral margins of the disk rectangulate in caudal two-thirds, obtuse in cephalic third, rounded in both sections, cut at one-third their length from the cephalic margin by a very brief sulcus, which does not extend over the disk of the pronotum, the latter with a broad V-shaped figure faintly cephalad of the middle, when seen from the side the portion of the disk caudad of this figure is plane, while that cephalad of the same is regularly ascending cephalad: lateral lobes of the pronotum slightly deeper than long, the dorsal length contained one and one-fifth times in the depth; cephalic margin arcuato-emarginate, ventro-cephalic angle rounded obtuse, the ventral margin relatively short, oblique, rotundato-truncate, ventro-caudal angle broadly rounded-rectangulate, caudal margin flattened arcuate, slightly oblique ventro-cephalad in direction, humeral sinus relatively small, but acute and sharply indicated: surface of disk and lobes cribroso-punctulate, the indentations finer cephalad on the disk and the dorsal section of the lateral lobes than elsewhere.

Tegmina elongate and ample, their length slightly greater than one and two-thirds times the body length, the greatest width contained two and one-third times in the greatest length of the same, the general form of the tegmen acuminate ovate-lanceolate, the greatest width at five-eighths of the length from the base: costal margin regularly and strongly arcuate, apex slightly acute, the immediate apex rather narrowly rounded, sutural margin faintly arcuate distad to the distal third, thence broadly arcuate and in the remainder of the margin (subapical portion) oblique subtruncate to the apex: marginal field very broad in the proximal two-thirds of the tegmina, distad of this point the curving of the humeral trunk restricts the marginal field to a mere edging, the greatest width of the field (at the proximal third of the tegmen) slightly more than one-third of the greatest tegminal width and two-fifths of the entire tegminal width at the proximal third; anal field relatively narrow and elongate: mediastine vein short, subobsolete; rami of the humeral vein, which cross the marginal field, all regularly trend in the direction of the base of the tegmen as they diverge toward the costal margin, these rami more numerous and crowded distad; humeral trunk sigmoid, the arcuate at the distal third very decided when compared with that at the proximal third; median vein diverging from the discoidal vein very shortly before the middle of the tegmen,

for a short distance paralleling the discoidal vein, bifurcate then diverging from the main humeral trunk at an angle of sixty degrees and in a fractured fashion reaching the oblique portion of the sutural margin; ulnar vein arcuate toward the humeral trunk, which it closely approaches, distad connected with the proximal ramus of the median vein by a short cross-vein, the ulnar vein with two oblique arcuate rami, which follow the general trend of the extremity of the main ulnar vein, a number of oblique cross-veins between the humeral trunk and the ulnar vein are also present, these having the same trend toward the base as they approach the humeral trunk, a peculiarity possessed by all the more prominent rami and cross-veins. Wings with the exposed portion very acute, projecting distad of the tegmina a distance subequal to the length of the pronotal disk.

Mesosternal lobes elongate, acute-angulate caudad, the angle very narrowly rounded, the external margin of the lobes gently arcuate, the lobes held in a nearly vertical position: metasternal lobes individually longitudinal, shorter proportionately than the mesosternal lobes, the caudal angle moderately acute, the angle narrowly rounded, the caudal and lateral margins moderately arcuate. Disto-dorsal abdominal segment moderately arcuate about the base of each cercus, the distal margin of the plate dorsad of the supra-anal plate weakly and broadly emarginate, the surface of the plate moderately concave mesad: supra-anal plate trigonal, slightly longer than the proximal width: cerci styliform, regularly tapering from the relatively incrassate base to the very slender distal portion, straight: ovipositor with its greatest length equal to four-fifths of the length of the pronotal disk, bent arcuate in proximal third, thence very gently arcuate, the greatest depth of the ovipositor equal to about two-fifths of the ovipositor length, the ovipositor very faintly narrowing in the distal half, the extremity obliquely arcuate-truncate, the obliquity towards the dorsal margin, the margin of the apex with deeply cut denticulations, which are larger mesad, other margins of the ovipositor unarmed: subgenital plate small, compressed trigonal, paired carinae converging distad.

Cephalic femora four-fifths as long as the disk of the pronotum, subcompressed, ventro-cephalic margin with five spines, genicular lobes bispinose: cephalic tibiae with the auditory foramina having rimate apertures on both faces. Median femora one and one-third times as long as the pronotal disk: median tibiae weakly expanded in the proximal half on the ventral surface, there subcompressed. Caudal femora in length equal to two-fifths of the length of the

tegmina, compressed, rather regularly tapering distad, the external face with a well-impressed but irregular pattern of the pagina; genicular lobes bispinose; ventral-external margin with a continuous series of twenty-one to twenty-two spines, the ventro-internal margin with a series of nine to ten spines restricted to the distal section of the margin, the spines of both margins of similar size and equally spaced, except that distad on the external margin they are more crowded than elsewhere; ventral surface moderately channelled: caudal tibiae in actual length slightly surpassing that of the caudal femora, faintly compressed proximad, the dorsal surface moderately deplanate, dorsal margins regularly spined, the ventral margins with a much sparser spination.

General coloration of the head and pronotum light yellowish-olive to ecru-olive, on the abdomen saccardo's-umber, on the venter of the same bister; tegmina and exposed portion of wings cource-green to light elm-green, blotched with chamois and cream-buff, probably through dessication of the original green color; limbs saccardo's-umber to ecru-olive. Eyes mottled prout's-brown and fuscous; antennae amber-brown, greenish proximad. Pronotum with the lateral angles of the disk rather obscurely lined with ochraceous-buff, the short sulci (paired) which intersect the lateral angles of the disk at the cephalic third are lined with black. Humeral trunk of the tegmina and the principal veins of the same lined with buffy, the veins other than those of the trunk with this passing into cedar-green; discoidal field and the adjacent portion of the marginal field with numerous, scattered, very small points of creamy-white. Ovipositor ochraceous-tawny, more or less distinctly edged with russet.

Length of body, 29.3 mm.; length of pronotum, 7.6; greatest (caudal) width of pronotal disk, 6.1; length of tegmen, 50; greatest width of tegmen, 21.4; length of caudal femur, 20; length of ovipositor, 6.1.

The type of this most interesting species is unique.

***Ischyra punctinervis* Brunner.**

1878. *I[schyra] punctinervis* Brunner, Monogr. der Phaneropt., p. 344, pl. VII, fig. 99a-b. [Matto Grosso, Brazil.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

This specimen is faintly smaller than the original measurements and shows no sanguineous punctations at the base of the tegmina, although the ivory areas and the rows of fuscous points bordering the veins are well marked. It fully agrees otherwise with the description.

PSEUDOPHYLLINAE.

***Meroncidius flavolimbatus* Brunner.**

1895. *Meroncidius flavolimbatus* Brunner, Monogr. der Pseudophyll., p. 150. [Paraguay; State of Espirito Santo, Brazil.]

Bonito, State of Pernambuco. January 11, 1883. (A. Koebele; on *Agave* sp.). One female. [U. S. N. M.]

This specimen fully agrees with the original description of the species, which can be distinguished from *marginatus* Walker by its smaller size, its relatively straighter cephalic femora, its slightly more compressed pronotum, which has the marginal color contrast moderately decided, and its less produced lateral angles of the meso- and metasternum. The present species has the same type of mottled light and dark coloration of the sutural margin of the tegmina found in *marginatus*, but as the general color is darker the pale areas are reduced in size and less conspicuous. At first glance *flavolimbatus* might be taken for a small specimen of *marginatus*, but the structural differences appear to be sufficiently marked to distinguish the two.

***Meroncidius marginatus* Walker.**

• 1870. *Meroncidius marginatus* Walker, Catal. Spec. Derm. Salt. Brit. Mus., III, p. 450. [Pará, Brazil.]

Bonito, State of Pernambuco. January 11, 1883. (A. Koebele; on *Agave* sp.). One male, two females. [U. S. N. M.]

These specimens agree with Walker's description of the species, which is close to *ochraceus* of Stoll. The older species, however, as understood by Brunner, has unicolorous antennae, the ovipositor without distal rugae, very much greater general size and a distinctly longer, although no deeper, ovipositor.

***Anchiptolis chapadensis* Bruner.**

1915. *Anchiptolis chapadensis* Bruner, Ann. Carneg. Mus., IX, p. 355. [Chapada, Matto Grosso, Brazil.]

Chapada, State of Matto Grosso. June and September. (H. H. Smith.) Two males, three females. [U. S. N. M.]

These specimens fully agree with the original description, which was based on a single female. Several features of the male sex are worthy of comment. The stridulating field of the male tegmina occupies about one-fourth of the sutural section of the tegmina. The two disto-dorsal abdominal segments are shining black, as in the female sex. Supra-anal plate rather short, trigonal in form, with the distal angle produced into an acute process; cerci short, incrassate, faintly inbowed, the apex recurved with a straight tooth,

the ventro-lateral section of the shaft with a shallow longitudinal impression; subgenital plate distinctly narrowed distad, the distal extremity very narrowly and quite deeply U-emarginate; styles rather short, cylindrical, ventral surface subsulcate.

The measurements (in millimeters) of the present material are as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen	Length of caudal femur	Length of ovipos- itor
♂.....	23 ⁴⁷	7.9	5.1	29.2	6.3	19.5	.....
♂.....	32.7	8.8	5.4	34.5	7.5	22.2	.....
♀.....	33.5	8.7	5.5	38	8.7	20.6	16.9
♀.....	31	8.1	5.4	37.5	8	22	17.6
♀.....	28	8.1	5.3	36.5	8.5	22.7	17.2

***Tanusia angulata-ocellata* Brunner**

1895. *Tanusia angulato-ocellata* Brunner, Monogr. der Pseudophyll., p. 251. [Brazil.]

Canta Gallo, State of Rio de Janeiro. (Dr. Teuscher; Thayer Expedition.) One female. [M. C. Z.]

This specimen is typical except that the proximal three-fifths of the tegmina is green, instead of ferruginous as described. We know there is dichromatism in some of the *Pterochrozae* (i. e. *Mimetica*) and this is apparently a case of the same sort. We have not used Serville's *picturata* for this species, an action taken by Kirby, as we do not feel convinced the older name was applied to the same species as Brunner's *angulato-ocellata*.

This is the first record of the species with exact locality.

COPIPHORINAE.

***Copiphora producta* (Bolivar).**

1903. *Copiphora producta* Bolivar, Revista Chilena Hist. Nat., VII, p. 143. [Paraguay.]

Goyaz, State of Goyaz. One male. [Hebard Cln.]

This specimen shows a few differences from the description, which was based on the female sex, but these are chiefly in measurements and are probably due to sexual difference in proportions. The development of the caudal section of the pronotum is exactly as described by Bolivar.

The species has been recorded from Rio de Janeiro, Brazil, and "Province del Sara", Bolivia, by Bruner.

⁴⁷ This measurement is unnaturally small, as the abdomen is shrunken.

***Oxyprora flavicornis* Redtenbacher.**

1891. *Oxyprora flavicornis* Redtenbacher, Verhandl. k.-k. Zool.-botan. Gesell. Wien, XLI, p. 360. [Bahia, Brazil.]

Goyaz, State of Goyaz. One female. [Hebard Cln.]

Chapada, State of Matto Grosso. July and October. (H. H. Smith.) Three males, one female. [U. S. N. M.]

One male is decidedly brownish, apparently indicating the presence of a brown phase in the species.

Previous records were of its occurrence at Chapada, by Bruner,⁴⁸ and Urucum, near Corumbá, Matto Grosso, by Giglio-Tos.⁴⁹

***Caulopsis lancifera* new species.** (Plate XI, figs. 34, 35, 36, 37 and 38.)

Closely related to *C. cuspidata* Scudder, from Cuba, but differing in the more compressed form, more elongate fastigium, which is also deeper and faintly decurved distad, in the more retreating face, in the much reduced stridulating field of the male tegmina, which has the tambourine hardly half the size of that found in *cuspidata*, in the narrower and more acuminate tegmina, the more deeply divided disto-dorsal abdominal segment of the male, the armament of the male cerci and the more deeply emarginate subgenital plate.

TYPE.—♂; Corumbá, Matto Grosso, Brazil. March. (H. H. Smith; lowland.) [United States National Museum.]

Size rather small: form very elongate: surface of head, pronotum, pleura and sterna cribroso-punctulate. Head with the greatest dorsal length (from apex of fastigium) nearly twice as great as the length of the pronotal disk: dorsal line of occiput and fastigium in greater part faintly and regularly ascending cephalad: fastigium with its dorsal length subequal to the length of the occiput and inter-ocular region of vertex, lanceolate, faintly narrowed proximad, subequal in width of remainder of proximal half, then narrowing distad to the strongly blunted apex; ventral line of fastigium, when seen from the side, faintly concave; ventral surface non-carinate, but deeply punctate, proximal tooth prominent, completely in contact with the fastigium of the face; facial line, when seen from the side, greatly retreating, straight: eyes hardly prominent, ovate-orbicular in basal outline: antennae at least two and one-half times as long as body.

Pronotum of the usual type for the genus, the greatest caudal width of the pronotal disk contained nearly twice in the greatest length of the same: cephalic margin of disk weakly arcuato-emarginate, cauda margin of disk arcuato-truncate, lateral angles of disk distinct but well rounded, except caudad, when they are slightly more decided shoulders; transverse sulcus placed slightly cephalad of the cephalic

⁴⁸ Ann. Carneg. Mus., IX, p. 389, (1915).

⁴⁹ Boll. Mus. Zool. Anat. Comp. Torino, XV, no. 377, p. 7, (1900).

third, a fine medio-longitudinal sulcus impressed for some distance caudad of the transverse sulcus: lateral lobes of the pronotum distinctly longitudinal; cephalic margin of lobes strongly oblique, arcuato-truncate; ventro-cephalic angle hardly indicated; ventral margin oblique truncate; ventro-caudal angle rounded obtuse, caudal margin strongly arcuate; humeral sinus deep, well rounded rectangulate. Tegmina elongate lanceolate, the greatest width contained slightly more than nine times in the length, surpassing the apex of the abdomen by more than twice the dorsal length of the head: costal margin straight except for a regular arcuation in the distal third to the sutural apex, which is rather well rounded: stridulating field small, in its entirety not quite two-thirds as long as the dorsum of the pronotum, free margin but moderately arcuate, stridulating vein not more pronounced than the other veins of the field. Wings equalling the tegmina.

Prosternal spines very elongate, aciculate, parallel; sternal lobes strongly compressed, those of mesosternum rounded rectangulate, of metasternum arcuate laterad, with an extremely faint obtuse-angulation caudad. Disto-dorsal abdominal segment with a broad, relatively shallow, obtuse-angulate depressed area on the distal half of the dorsal surface, this area deepest disto-mesad and its proximal outline is rectangulate, the distal margin obtuse-angulate emarginate, the supra-cercal angles moderately acute, cercal emarginations relatively deep, broad, truncate at the bottom: subgenital plate reflexed, linguiform: cerci of medium length, moderately robust, covered with shagreenous points which give rise to short chaetiform and long piliform hairs; when seen from the dorsum the cerci are nearly straight, when seen from the side they are moderately regularly arcuate, subequal in depth; apex obliquely subtruncate, supplied with two spines, one large and cultriform, directed dorsad, the other aciculate, directed toward the median line and placed distad of the cultriform spine; subgenital plate compressed, relatively short, distal margin narrowly fissate-emarginate; styles articulate, short.

Cephalic and median limbs relatively short, comparatively slender: caudal femora elongate, slender, one-half as long as the tegmina; ventro-external margin with two to five spines, ventro-internal margin with two to three spines. Genicular lobes unarmed except those of the caudal femora and the caudal one on the median femora.

ALLOTYPE.—♀; Iça, River, State of Amazonas, Brazil. (Thayer Expedition.) [Museum of Comparative Zoology.]

This specimen differs from the description of the type in the following features. Size larger, form faintly more robust. Head with the greatest dorsal length one and a half times as long as the pronotal disk; dorsal line of occiput and fastigium faintly and regularly ascending; facial line slightly less retreating than in the male; antennae broken. Cephalic margin of disk of pronotum very faintly more angulato-emarginate than in the male; greatest caudal width of pronotal disk three-fifths of length of same. Disto-dorsal abdominal segment deeply and narrowly V-emarginate mesad: cerci terete, tapering in distal third, acute, faintly arcuate when seen from the side; ovipositor in length subequal to that of the dorsum of the head and pronotum together, relatively broad, subequal in width, faintly decurved in distal two-thirds, apex acute: subgenital plate produced trigonal, compressed, subcarinate ventrad, distal margin narrow, shallowly arcuate-emarginate. Caudal femora slightly less than one-half as long as the tegmina: ventro-external margin armed with three to four, ventro-internal margin with two to three spines.

General color serpentine-green to old-gold above, beneath old gold to dull yellow-ocher. Eyes russet; antennae dresden-brown to buckthorn-brown, passing into the general color proximad. Larger areas of the male stridulating field washed to a variable degree with mummy-brown. Tibial spines yellowish, tipped with brownish. The female (*allotype*) has lost all trace of the original coloration, the above features being derived entirely from the type and paratype.

Measurements (in millimeters.)

	Length of body	Length of fas- tigium	Length of pro- notum	Greatest caudal width of pro- notum	Length of tegmen	Greatest width of tegmen	Length of caudal femur	Length of oviposi- tor
♂, Corumbá, Brazil, type.....	24	3.6	4.3	2.2	29.2 ⁵⁰	3.1	14.8	.....
♂, Corumbá, Brazil, <i>paratype</i>	23	3.1	4	2.2	28.2	2.6	13.2	.....
♀, Iça River, Brazil, <i>allotype</i>	29 ⁵¹	4	4.6	2.8	35.2	3.5	15.8	12.9

In addition to the type and allotype we have before us a paratypic male bearing the same data as the type. It is a smaller insect than

⁵⁰ Apices damaged. Measurement approximate.

⁵¹ Exclusive of ovipositor.

the type, with the fastigium relatively shorter, but it is clearly the same species as the described individual. The number of spines on the ventro-external margin of the caudal femora is two to five in the paratype.

***Neoconocephalus irroratus* (Burmeister).**

1838. *C[onocephalus] irroratus* Burmeister, Handb. der Entom., II, abth. II, pt. 1, p. 705. [Brazil.]

Bonito, State of Pernambuco. February, 1883. (A. Koebele.)
Three females. [U. S. N. M.]

These specimens have lost all of their original coloration, from liquid immersion, but they are inseparable from well preserved specimens from other localities.

***Neoconocephalus vicinus* Karny.**

1907. *Neoconocephalus vicinus* Karny. Abb. k.-k. Zool.-bot. Gesell. Wien, IV, heft. 3, pp. 26, 34. [Rio Grande do Sul (Brazil): Paraguay.]

Chapada, State of Matto Grosso. May and June. (H. H. Smith). Four females. [U. S. N. M.]

These individuals have been compared with specimens from Sapucay, Paraguay. Two of the series are in the brownish phase of coloration, with the costal margin of the tegmina finely lined with fuscous, while the others are in the greenish phase, with the tegmina not lined. The degree of completeness of the blackish marking on the venter of the fastigium varies appreciably.

We have every reason to believe that Bruner's *Neoconocephalus longifossor*, described from Chapada,⁵² is identical with this species.

***Bucrates*⁵³ *capitatus* (DeGeer).**

1773. *Locusta capitata* DeGeer, Mém. Hist. Ins., III, p. 455, pl. 40, fig. 1. [Unknown locality.]

Bonito, State of Pernambuco. February 15, 1883. (A. Koebele.)
One immature female. [U. S. N. M.]

⁵² Ann. Carneg. Mus., IX, p. 395, (1915).

⁵³ Scudder's *Conocephalus clausus* (Proc. Boston Soc. Nat. Hist., XX, p. 94, (1878)), from Jalisco (in error, Jalasco), Mexico, we find, on examination of the unique type, to be a *Bucrates*. It differs from *capitatus* in the more compressed form, more elevated fastigium, shorter lateral lobes of the pronotum, the greatly elongate tegmina, while the ovipositor is shorter, decurved in distal half and there quite broad, distinctly broader than proximad. A number of other features of difference in *clausus*, such as more prominent eyes, less deeply emarginate subgenital plate, more deeply impressed transverse sulcus of the pronotum, different areolation of the marginal field of the tegmina, etc., are also present. The species has the caudal tibiae strongly expanded laterad. No close affinity to *Parabucrates* is noticed, while it has no affinity with *Homorocoryphus*, or the species *H. laticeps*, as suggested by Karny (Gen. Insect. Orth., Copiphorinae (fasc. 139), p. 38).

We have compared this individual with an adult female from La Piedrita, Venezuela (II, 16, 1911; Stewardson Brown), in the collection of the Academy, and as far as can be determined from the immature specimen, which is in the instar preceding maturity, the two represent the same species. Redtenbacher has recorded the species from Bahia.

LISTROSCELINAE.

Listrocelis atrata Redtenbacher.

1891. *Listrocelis atrata* Redtenbacher, Verhandl. k.-k. Zool.-bot. Gesell. Wien, XLI, pp. 544, 545. [Nova Friburgo (Neu Freiburg), State of Rio de Janeiro, Brazil.]

Espirito Santo, Brazil. One male. [Hebard Cln.]

This specimen is somewhat larger than the measurements given by Redtenbacher, but it does not appear to differ in other features. From the closely related *L. carinata* Karny, the present specimen differs, as does the description of *atrata*, in the longer and strongly arcuate process of the left mandible and the straight cerci.

The localities given above are all known for the species.

CONOCEPHALINAE.

Conocephalus iriodes Rehn and Hebard.

1915. *Conocephalus iriodes* Rehn and Hebard, Trans. Amer. Entom. Soc., XLI, pp. 231, 258, pl. XXI, fig. 6, pl. XXII, figs. 5 and 23, pl. XXIII, figs. 12 and 13, pl. XXIV, fig. 5. [Cuidad Bolivar and Maripa, Venezuela; Kaiteur (type and allotype) and Rockstone, British Guiana; Ireng River near Roraima, British Guiana; Bonito, Pernambuco, Brazil.]

Bonito, State of Pernambuco, January 7 and 15, 1883. (A. Koebele.) One male. [U. S. N. M.]

This specimen, like the female from the same locality previously recorded by us, has been immersed in alcohol or a similar preservative, so that to-day its distinctive coloration is almost entirely lacking. The caudal limbs and the cephalic and median ones on the left side are missing, but all the important structural features of the species are evident. The tegmina are longer than in any of the other males measured by us, being but slightly shorter (18.3 mm.) than those of the female from the same locality previously measured.⁴⁴

Conocephalus saltator (Saussure).

1859. *X[iphidium] saltator* Saussure, Rév. et Mag. de Zool., 2é ser. XI, p. 208. [Guiana.]

Bonito, State of Pernambuco, January 27, 1883. (A. Koebele.) One male. [U. S. N. M.]

This specimen is of the brachypterous type.

⁴⁴ Vide supra.

GRYLLIDAE.

GRYLLOTALPINAE.

***Scapteriscus vicinus* Scudder.**

1869. *Scapteriscus vicinus* Scudder, Mem. Peabody Acad. Sci., I, pp. 7 and 12, pl. 1, figs. 4 and 23. [Rio Negro; Piahy and Pará, Brazil; Panama; Rio Grande (Brazil?); Asia?]

State of São Paulo. (Hammar.) One male. [Cornell Univ.]

GRYLLINAE.

***Nemobius hebardi* Rehn.**

1915. *Nemobius* (*Argizala*) *hebardi* Rehn, Proc. Acad. Nat. Sci. Phila., 1915, p. 290, figs. 4 and 5. [Buenos Aires (type locality) and Misiones, Argentina.]

Bonito, State of Pernambuco. February 27, 1883. (A. Koebele.) One female. [U. S. N. M.]

This specimen fully agrees with the typical material, and, like the original individuals, has caudate wings.

This record carries the range of the species greatly to the northward.

OECANTHINAE.

***Oecanthus minutus* Saussure.**

1878. *Oe[canthus] minutus* Saussure, Mélang. Orthopt., II, fasc. VI, p. 594. [Pernambuco, Brazil.]

Bonito, State of Pernambuco. January 16, 1883. (A. Koebele; collected on cotton.) One male, one female. [U. S. N. M.]

These specimens show no differences worthy of mention from the original description. The disparity in size of the two faces of the foramina of the cephalic tibiae is quite evident, while in the measurements the female, which is the sex of the type, shows no noteworthy difference except that the tegmina are about one millimeter longer. The male tegmina is narrow, the greatest width of dorsal field contained two and one-half times in the greatest length of the same. Both of the present specimens are minus two to three legs and the coloration has been much affected in the male.

TRIGONIDIINAE

***Cyrtoxipha pernambucensis* new species. (Plate XI, fig. 39; text fig. 1.)**

This species is a relative of *C. gundlachi* (the genotype), from which it differs chiefly in the more deplanate head and more elongate eyes, which in basal outline are more pyriform than reniform; the head when seen from the cephalic aspect is much more strongly transverse and shallower in proportion to its depth than in *gundlachi*. The pronotum of the male is slightly less decidedly transverse, with a more marked cephalic narrowing than in *gundlachi*, while the tegmina of the male have the dorsal field slightly narrower

in *pernambucensis* than in *gundlachi*, with the speculum and the principal veins more longitudinal. Most of the limbs are missing in the unique type of *pernambucensis*. It is probable that the Pernambuco material referred to *gundlachi* by Saussure⁵⁵ belongs to this species.

TYPE.—♂; Bonito, State of Pernambuco, Brazil. January, 1883. (A. Koebele.) [United States National Museum.]

Size medium (for the genus); form slender but appreciably depressed; surface of body and limbs rather thickly clothed with short hairs. Head of the transverse depressed type characteristic of the genus; occiput and fastigium strongly and uniformly deplanate declivent when seen from the side, the fastigio-facial angle rectangulate; interspace between the eyes broad, faintly exceeding the greatest length of the eye, inter-antennal width of the frontal costa less than one-third of the interocular width, dorsum of the fastigium and cephalic section of occiput with a delicate medio-longitudinal sulcus: facial line, when seen from the side, slightly arcuate: palpi rather short, fourth joint slightly shorter than the third joint, fifth joint faintly shorter than the fourth, the fifth joint forming a nearly equilateral triangle, the distal margin truncate and but faintly shorter than the length of the joint: eyes distinctly longitudinal pyriform, the greatest depth, which is cephalad, contained about one and a half times in the eye length: antennae with the proximal joint broad, strongly depressed.

Pronotum transverse, the greatest caudal width one and two-thirds times the greatest length, the cephalic width about two-thirds the caudal width, when seen from the dorsum the pronotum is appreciably narrowed cephalad: cephalic margin of disk faintly arcuate, caudal margin of disk bisinuate-truncate; disk of the pronotum with a medio-longitudinal sulciform impression for the greater portion of its length, lateral angles of disk well rounded: lateral lobes of pronotum subrectangulate, distinctly longer than deep: cephalic margin, moderately oblique, truncate, ventro-cephalic

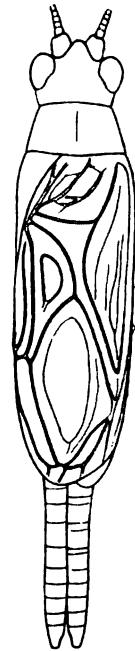


Fig. 1.—*Cyrtoxipha pernambucensis* new species. Dorsal outline of male (type). (× 8.)

⁵⁵ Mél. Orth., II, fasc. VI, p. 620, (1878).

angle well rounded, ventral margin subtruncate, ventro-caudal angle narrowly rounded, caudal margin straight; surface of lobes with an oblique, poorly delimited, broad depression, its general trend ventro-caudad.

Tegmina moderately narrow, their greatest width contained about two and one-half times in the greatest tegminal length; dorsal venation and areas strongly longitudinal in disposition (see figure 1); lateral venation with the mediastine vein moderately bi-sinuate, three short, free veins present, the second abbreviate. Wings surpassing the tegmina by about one and a half times the combined length of the head and pronotum. Cerci failing to reach the apices of the closed wings by about one-third the length of the exposed portion of the latter. Cephalic tibiae faintly fusiform: both faces with an elliptical foramen. Caudal limbs missing.

General coloration dull colonial-buff, apparently quite greenish in life. Eyes tawny, becoming russet ventro-cephalad.

Length of body, 6 mm.; length of pronotum, 1; greatest caudal width of pronotum 1.7; length of tegmen 5.3; greatest width of dorsal field of tegmen, 1.9.

The type is unique.

Anaxipha⁵⁶ aptera (Chopard).

1912. *Cyrtoripha aptera* Chopard, Ann. Soc. Entom. France, LXXXI, p. 410, 4 figs. [Charvein, St. Laurent and Nouveau-Chantier, French Guiana.]

Bonito, State of Pernambuco. January, 1883. (A. Koebele.)
One male. [U. S. N. M.]

Anaxipha olmeca (Saussure).

1897. *Cyrtoriphus olmecus* Saussure, Biol. Cent.-Amer., Orth., I, p. 236, pl. XI, figs. 42 and 43. (Teapa, Tabasco, Mexico.)

Bonito, State of Pernambuco. January, 1883. (A. Koebele.)
Two females. [U. S. N. M.]

The reference of this material to *olmecus* is provisional, as we have no Mexican individuals for comparison, and the Bonito representation is not in as good condition as could be desired. It shows, however, no differences worthy of mention from the original description and figures, and for the present must be referred here. This is the first South American record of the species.

ENEOPTERINAE.

Podoscirtus americanus Saussure.

1878. *P[odoscirtus] americanus* Saussure, Mélang. Orthopt., II, fasc. VI, pp. 776, 782. [Bahia, Brazil.]

⁵⁶ For comments on the characters separating *Cyrtoripha* and *Anaxipha*, see Rehn and Hebard, Entom. News, XXIII, pp. 411 and 412; Proc. Acad. Nat. Sci., Phila., 1916, pp. 300 to 302.

Bonito, State of Pernambuco. February, 1883. (A. Koebele.)
One female. [U. S. N. M.]

This specimen fully agrees with the description of the present species. The only really noteworthy difference is that the caudal tibiae have five spines on the external and six on the internal dorsal margins, instead of 5:5 or 4:3 as described.

This is, apparently, the first record of this magnificent species since the original description.

Aphonomorphus inopinatus new species. (Plate XI, figs. 40, 41 and 42; text figure 2.)

Apparently related to *A. mutus* (Saussure), from Guiana, from which it differs chiefly in the caudal margin of the pronotum being hardly angulate caudad, in the lateral lobes of the pronotum being more longitudinal than quadrate, in the more numerous (six) spines on the dorso-internal margin of the caudal tibiae, in the fewer (two) spines on the dorso-external margin of the caudal metatarsi and in the distal palpal joint not being black.

TYPE.—♀; Bonito, State of Pernambuco, Brazil. January, 1883. (A. Koebele.) [United States National Museum.]



Fig. 2.—*Aphonomorphus inopinatus* new species. Dorsal outline of tegmina of female (type). (× 3.)

Size medium: form moderately elongate, slightly depressed: surface of body and limbs rather sparsely pilose, of tegmina microscopically adpressed pilose. Head with its caudal width but faintly greater than the cephalic width of the pronotum, when seen from the cephalic aspect the greatest depth is slightly greater than the width across eyes: occiput weakly declivent, cephalad: ocelli of medium size, placed in an arcuate line; median one transverse elliptical, weakly fossetted cephalad, the interspaces between the median and lateral ocelli slightly greater than the short dimension of the median one; lateral ocelli sublongitudinal in position, ovate, larger than the median one, separated from the eyes by a distance subequal to that between the median and lateral ocelli: inter-antennal rostrum rounded obtuse-angulate when seen in lateral outline, its least width subequal to that of the proximal-antennal joint, dorsal section weakly fossetted: eyes but moderately prominent, slightly directed cephalad, subreniform and narrow ventro-cephalad in basal outline: palpi with the third joint relatively heavy; fourth joint subequal in length to the third, slender proximad; fifth joint elongate securiform, its length greater than the breadth of

the distal margin, which latter is truncate, the flexor margin straight, rounding into the distal margin, the extensor margin moderately but distinctly concave: antennae incomplete.

Pronotum transverse, the greatest median length contained nearly one and a half times in the greatest caudal width of the pronotum; in transverse section the dorsum of the pronotum is rather strongly arcuate, well rounding into the lateral lobes: cephalic margin of dorsum emarginato-truncate; caudal margin bisinuate laterad, rotundato-angulate mesad; lateral borders of the disk weakly diverging caudad, all pronotal margins excepting the usual lamellato-cingulate portion ventro-caudad on the lateral lobes, narrowly cingulate: medio-longitudinal line weakly impressed; pyriform impressions transverse, elongate: lateral lobes longitudinal, their depth contained nearly twice in their length, moderately impressed ventro-caudad; ventro-cephalic angle and ventral margin arcuate, ventro-caudal angle rounded obtuse.

Tegmina very slightly surpassing the tips of the caudal femora, relatively narrow, the lateral borders of the dorsal field subparallel proximad, faintly arcuate convergent distad: lateral field rather narrow, subequal in width in the proximal third, very gradually narrowing thence to the distal fourth, from which point distad it more sharply narrows; mediastine vein with four to five rami and the field with five free veins proximad; dorsal field with its greatest width contained about five times in the greatest tegminal length; ulnar vein strongly sinuate at about its middle; anal vein with a faint sinuation slightly proximad of its middle; axillary veins (two) simple; median vein with four oblique rami distad, which are not strongly marked, yet form with the ulnar and anal veins the usually distinct pattern of oblique "sectors" found in most of the species of the genus; longitudinal sinuate intercalated nervures and short cross-veins evident. Closed wings extending distad of the tegmina a distance equal to about one and one-third times the length of the pronotum.

Limbs moderately robust, the cephalic and median femora quite deep, moderately compressed. Cephalic tibiae with a small elliptical foramen on the cephalic face, the caudal face imperforate. Caudal femora one and two-fifths times as long as the tegmina, regularly narrowing distad: caudal tibiae subequal to the femora in length; dorso-external margin armed with five major spines, the dorso-internal with six, the dorso-external margin with 3-2-2-1 intercalated spinulations, the internal with 2-2-1-2-0; external distal spurs very

small, dorso-internal spur twice as long as the ventro-internal one: caudal metatarsi with two spinulations on the external, and a single one on the internal, margins; internal distal metatarsal spur subequal to the metatarsus in length. Ovipositor slightly longer than the caudal femora, the structure of the apices very similar to that of the recently described *A. surdus* Rehn,⁵⁷ the marginal teeth, however, slightly smaller, more regular and more acute.

General coloration ochraceous-buff; a pronounced grouping of spots along the cephalic, and a less decided row of the same along the caudal, margins of the dorsum of the pronotum, fuscous; a poorly defined speckling on the limbs and over much of the pronotum, cinnamon-brown; eyes cinnamon-brown; tegmina pencilled in weak tawny, the proximal third of the humeral vein lined ventrad with fuscous; ovipositor tipped with fuscous.

Length of body, 13.6 mm.; length of pronotum, 2.8; greatest (caudal) width of pronotum, 3.9; length of tegmen, 15.5; greatest width of dorsum of tegmen, 3; length of caudal femur, 11; length of ovipositor, 11.8.

In addition to the type we have before us a paratype female with the same data as the type, except that it was taken in February, 1883. This specimen is slightly larger than the type and has been badly damaged, lacking all the limbs excepting the dextral median one and the dextral caudal femur, while the tegmina are not perfect. It is in a more intensive type of coloration than the type, having the punctulation much heavier, far more numerous and fuscous; washes on the fastigium, in the median area of the pronotum, irregular beading along the median vein of the tegmina and a spot at the base of the humeral trunk, cloudings on the tegminal "sectors" and beading along the ventral margins of the caudal femora, fuscous.

Nessa vectis new species. (Plate XI, fig. 43; text figure 3.)

This species is referred to *Nessa* provisionally, as it may prove to be generically distinct from the poorly known genus of Walker. From the description of the genus *Nessa*, and the genotypic *N. linearis*, the new species differs in the pronotum being slightly broader than long, in the ovipositor faintly surpassing the length of body and very much longer than the abdomen, in the caudal tibiae having six external and seven internal spines on the dorsal margins, in the

⁵⁷ PROC. ACAD. NAT. SCI. PHILA., 1918, p. 230, pl. II, figs. 71, 72, 73 and 74, (1918).

caudal femora being without distinct black markings and the tegmina with the veins unlined with piceous, and in the smaller size. Some affinity is shown to *Parametrypa* and some similarity to *Cylindrogryllus* and *Tapinopus* is noted, but from the former the new species differs chiefly in the femoral spination, as well as the elongate and fully developed tegmina, while the shorter pronotum, elongate tegmina, tibial and metatarsal spination, and the abbreviate distal caudal tibial spurs are the more readily perceived features of difference from *Cylindrogryllus*. From *Tapinopus* the new form differs in the shorter head, shorter and simpler pronotum, the imperforate cephalic tibiae, the short cephalic tarsi and the slender ovipositor, which has the distal valves short and slender.



Fig. 3.—*Nessanectis* new species. Dorsal outline of female (type). ($\times 3\frac{1}{2}$).

TYPE.—♀; Bonito, State of Pernambuco, Brazil. January 17, 1883. (A. Koebele.) [United States National Museum.]

Size medium: form quite elongate, slender, subequal in width: surface of body and limbs with adpressed pile, on the tegmina a similar, but more decidedly microscopical, pile covering is present. Head with its caudal width slightly greater than the cephalic width of the pronotum, depressed, dorsal surface deplanate, greatest width across eyes but faintly less than the greatest length of the head, the greatest depth of the head distinctly less than the greatest width: occiput gently rounded, the interocular portion of the dorsum plane, almost imperceptibly excavate; ocelli placed in a strongly arcuate line, small, the median one slightly smaller than the lateral ones, the median ocellus fossetted cephalad, all the ocelli well separated from each other and also from the eyes: interantennal rostrum with the width subequal to that of the proximal antennal joint, the lateral outline of the rostrum arcuate obtuse-angulate when seen from the side: palpi moderately elongate; fourth joint slightly shorter than the third joint; fifth joint elongate securiform, its flexor length slightly greater than that of the oblique subtruncate distal margin: eyes hardly prominent, elliptical in basal outline, slightly declivent cephalad in their general trend from the horizontal: antennae broken.

Pronotum with the greatest dorsal width about a fourth greater than the median length, the disk weakly transverse, the lateral bor-

ders faintly bowed outward mesad, but the cephalic width is subequal to that caudad; in transverse section the disk is arcuato-deplanate: cephalic margin very faintly and broadly arcuato-emarginate; caudal margin weakly bisinuate-laterad, very slightly and broadly arcuato-angulate; cephalic margin rather narrowly, caudal margin more broadly, cingulate: surface with a narrow medio-longitudinal line, which is delicately filiform cephalad and caudad more broadly and conspicuously indicated; pyriform impressions distinct, rather large, moderately elongate, more approximated than usual; lateral lobes strongly longitudinal, the greatest depth of the lobes contained slightly more than twice in their length, the depth in general subequal; ventro-cephalic angle rounded rectangulate, ventral margin straight, horizontal for two-thirds of its length; ventro-caudal angle obliquely rotundato-truncate, passing into the caudal margin; surface of the lobes with the point of impression ventro-caudad.

Tegmina reaching to the apex of the abdomen, elongate, slender, lateral borders of the dorsal field parallel: costal margin straight; mediastine vein with six oblique rami, three of which are short and distal and three elongate and proximal in origin; marginal field with one free vein proximad; humeral and discoidal veins following the curve of the mediastine vein, simple: dorsal field narrow, its greatest width contained about five and a half times in the greatest length of the same; median vein straight, with two poorly defined rami distad; ulnar vein bifurcate; simple anal and two axillary veins unbranched, regularly placed, nearly longitudinal; veins of the dorsal field almost longitudinal, subparallel, the interspaces with numerous, generally irregular, cross-veins, which are never as distinct as the principal veins and rarely form regularly shaped areolae. Wings, when closed, with their folded tips very briefly surpassing the tegmina. Cerci faintly more than twice as long as the pronotum, tapering, supplied with rather short hairs and elongate, more erect, hairs: ovipositor slightly surpassing the body in length, very slender, weakly compressed, in lateral outline weakly sinuate proximad, moderately curved dorsad in distal three-fifths; surface of the lateral aspects microscopically rugulose; distal valves little inflated, strongly acuminate, ventral surface of valves with a series of weakly recurved, serrate teeth, these decreasing in size distad.

Cephalic and median limbs moderately robust, rather short; cephalic tibiae imperforate, cephalic and median tarsi short. Caudal femora but faintly shorter than the tegmina, moderately robust, regularly

tapering distad: caudal tibiae but faintly shorter than the femora; dorsal margins armed with six external major spines and seven internal ones, the intercalated spinulations numbering 3-2-2-2-0 on the external, and 3-2-1-1-1-0 on the internal margin; distal spurs of the external side small, the internal side having the dorsal distal spur slightly less than twice as long as the ventral one: caudal metatarsi very short, the dorsal surface with two external and one internal spinulations, distal spurs of both sides slightly surpassing the second tarsal joint.

General coloration pale buckthorn-brown, the head inclining toward dresden-brown, the venter of the abdomen ochraceous-tawny. Ocellar region outlined dorsad with fuscous, a V-shaped patch of the same on the occiput; eyes auburn with a median and a dorsal thread of fuscous. Pronotum with a fuscous medio-longitudinal line which is almost completely divided by a thread of the general color, points of fuscous regularly disposed along the cephalic and caudal margins of the disk and along the lateral border of the same, a very faint wash of russet suggesting a post-ocular bar. Tegmina with a moderately broad bar embracing the humeral vein, fuscous, bordered suturad by the pale ochraceous-buff pencilling of the median vein. Abdomen with the dorsum shining blackish-fuscous. Caudal tibiae dorsad weakly washed with mummy-brown. Ovipositor finely lineate on the external surface with blackish-fuscous, the valves chestnut with blackish-fuscous teeth.

Length of body, 16.5 mm.; length of pronotum, 2.7; greatest (caudal) width of pronotum disk, 3; length of tegmen 13.8; greatest width of dorsal field of tegmen, 2.3; length of caudal femur, 12.3; length of ovipositor, 18.5.

The type of this very striking and peculiar species is unique.

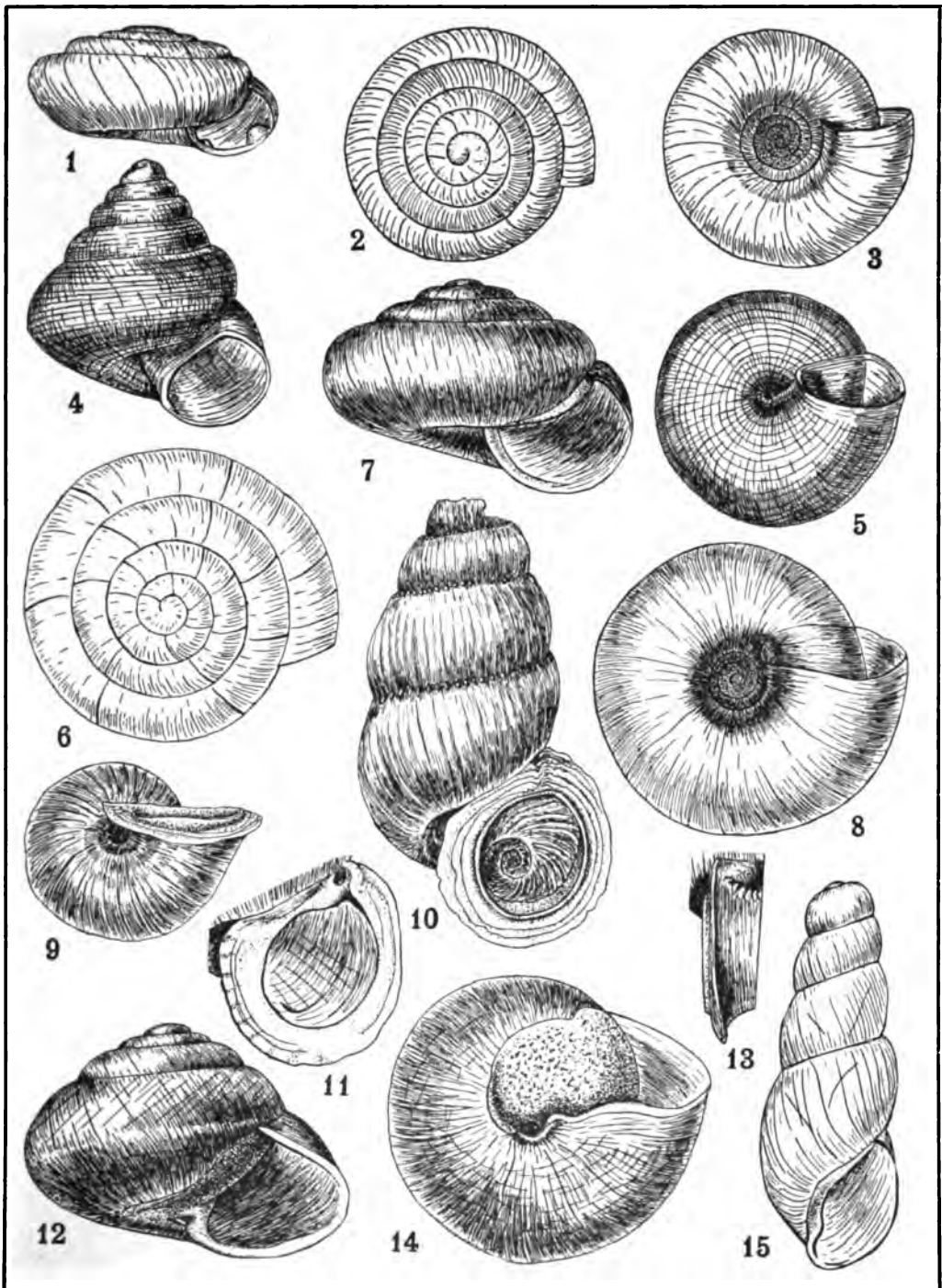
EXPLANATION OF PLATES X, XI.

PLATE X.

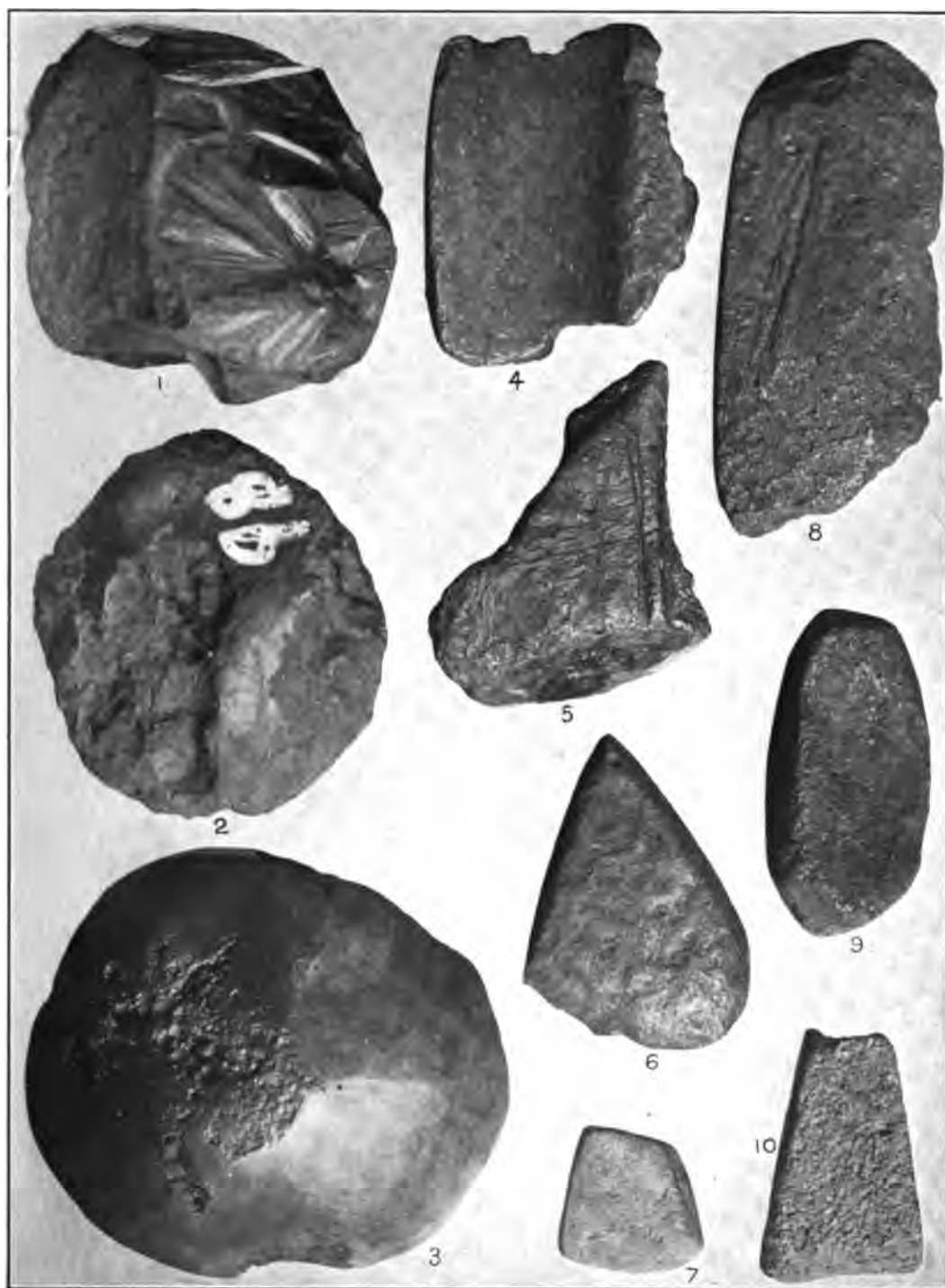
- Fig. 1.—*Trachymiopteryx tuberculata* new genus and species. Dorsum of pronotum of male (TYPE). ($\times 4$)
- Fig. 2.—*Trachymiopteryx tuberculata* new genus and species. Outline of cephalic aspect of head of male (TYPE). ($\times 4$)
- Fig. 3.—*Musonia costalis* new species. Outline of dorsum of pronotum of male (TYPE). ($\times 6$)
- Fig. 4.—*Musonia costalis* new species. Outline of cephalic aspect of head of male (TYPE). ($\times 4$)
- Fig. 5.—*Oxyopsis oculea* new species. Outline of dorsum of pronotum of female (TYPE). (Natural size.)
- Fig. 6.—*Oxyopsis oculea* new species. Cephalic aspect of head of female (TYPE). ($\times 4$)
- Fig. 7.—*Oxyopsis oculea* new species. Apex of tegmen and wing of female (TYPE). (Natural size.)
- Fig. 8.—*Parastagmatoptera glauca* new species. Dorsal outline of pronotum of female (TYPE). ($\times 3$)
- Fig. 9.—*Parastagmatoptera glauca* new species. Cephalic aspect of head of female (TYPE). ($\times 3$)
- Fig. 10.—*Dyme straminea* new species. Dorsal outline of apex of abdomen of male (TYPE). ($\times 2$)
- Fig. 11.—*Dyme straminea* new species. Lateral outline of apex of abdomen of male (TYPE). ($\times 2$)
- Fig. 12.—*Bactridium grande* new species. Lateral outline of apex of abdomen of female (TYPE). (Natural size.)
- Fig. 13.—*Diponthus bilineatus* new species. Dorsal view of head and pronotum of male (TYPE). ($\times 3$)
- Fig. 14.—*Diponthus crassus* Bruner. Misiones, Argentina. Dorsal view of head and pronotum of male. ($\times 3$)
- Fig. 15.—*Diponthus bilineatus* new species. Lateral outline of apex of abdomen of male (TYPE). ($\times 3$)
- Fig. 16.—*Diponthus crassus* Bruner. Misiones, Argentina. Lateral outline of apex of abdomen of male. ($\times 3$)
- Fig. 17.—*Ligocatinus sordidus* new species. Cephalic aspect of dorsal portion of head of female (TYPE). (Greatly enlarged.)
- Fig. 18.—*Ligocatinus sordidus* new species. Lateral view of ovipositor of female (TYPE). ($\times 6$)
- Fig. 19.—*Ligocatinus minutus* new species. Lateral outline of pronotum of male (TYPE). ($\times 6$)
- Fig. 20.—*Ligocatinus minutus* new species. Dorsal outline of apex of abdomen of male (TYPE). ($\times 6$)
- Fig. 21.—*Anaulacomera bellator* new species. Lateral outline of pronotum of male (TYPE). ($\times 6$)
- Fig. 22.—*Anaulacomera bellator* new species. Cercus of male (TYPE). (Greatly enlarged.)
- Fig. 23.—*Anaulacomera intermedia* Bruner. Petropolis, Brazil. Cercus of male. (Greatly enlarged.)
- Fig. 24.—*Anaulacomera libidinosa* new species. Lateral view of cercus of male (TYPE). (Greatly enlarged.)

PLATE XI.

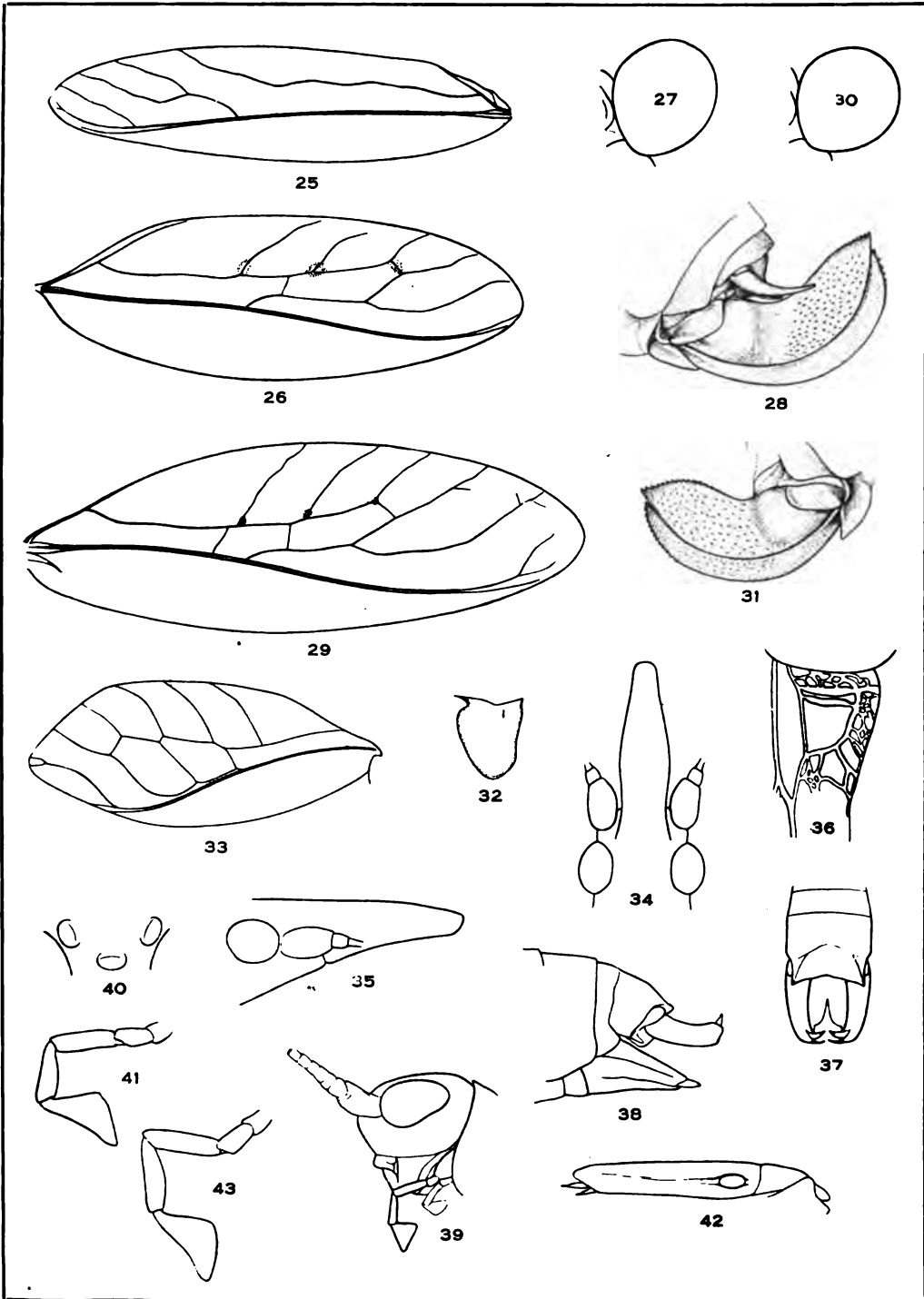
- Fig. 25.—*Anaulacomera libidinosa* new species. Lateral outline of right tegmen of male. ($\times 2\frac{1}{2}$)
- Fig. 26.—*Phylloptera tenella* new species. Lateral outline of left tegmen of female (TYPE). ($\times 2\frac{1}{2}$)
- Fig. 27.—*Phylloptera tenella* new species. Outline of eye in latero-cephalic aspect. Female (TYPE). (Greatly enlarged.)



VANATTA: NEW LAND SHELLS.



WARDLE: IRON ORE ARTIFACTS.



REHN: BRAZILIAN ORTHOPTERA.

- Fig. 28.—*Phylloptera tenella* new species. Lateral view of ovipositor of female (TYPE). (Greatly enlarged.)
- Fig. 29.—*Phylloptera cognata* new species. Lateral outline of left tegmen of female (TYPE). ($\times 2\frac{1}{2}$)
- Fig. 30.—*Phylloptera cognata* new species. Outline of eye in latero-cephalic aspect. Female (TYPE). (Greatly enlarged.)
- Fig. 31.—*Phylloptera cognata* new species. Lateral view of ovipositor of female (TYPE). (Greatly enlarged.)
- Fig. 32.—*Lobophyllus reversus* new species. Lateral outline of pronotum of female (TYPE). ($\times 1\frac{1}{2}$)
- Fig. 33.—*Lobophyllus reversus* new species. Lateral outline of right tegmen of female (TYPE). (Natural size.)
- Fig. 34.—*Caulopsis lancifera* new species. Dorsal outline of fastigium of male (TYPE). (Greatly enlarged.)
- Fig. 35.—*Caulopsis lancifera* new species. Lateral outline of fastigium of male (TYPE). (Greatly enlarged.)
- Fig. 36.—*Caulopsis lancifera* new species. Dorsal outline of stridulating field of left tegmen of male (TYPE). (Greatly enlarged.)
- Fig. 37.—*Caulopsis lancifera* new species. Dorsal outline of apex of abdomen of male (TYPE). (Greatly enlarged.)
- Fig. 38.—*Caulopsis lancifera* new species. Lateral outline of apex of abdomen of male (TYPE). (Greatly enlarged.)
- Fig. 39.—*Cyrtoxipha pernambucensis* new species. Lateral outline of head of male (TYPE). (Greatly enlarged.)
- Fig. 40.—*Aphonomorphus inopinatus* new species. Ocelli of female (TYPE). (Greatly enlarged.)
- Fig. 41.—*Aphonomorphus inopinatus* new species. Palpus of female (TYPE). (Greatly enlarged.)
- Fig. 42.—*Aphonomorphus inopinatus* new species. Cephalic face of cephalic tibia of female (TYPE). (Greatly enlarged.)
- Fig. 43.—*Nessa vectis* new species. Palpus of female (TYPE). (Greatly enlarged.)

November 16, 1920.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Eighteen persons present.

HENRY A. PILSBRY, Sc.D., made a communication on "Hawaii and the Pan-Pacific Scientific Conference," illustrated by lantern slides. (No abstract.)

The Publication Committee reported the receipt of the following papers for the PROCEEDINGS:

"Scrophulariaceae of Colombia—I," by Francis W. Pennell.

"Two New Cyprinoid Fishes from Formosa," by Masamitsu Oshima.

"Mollusks from Lake Chapala, State of Jalisco, and Vicinity," by Henry A. Pilsbry.

"New Land Shells," by E. G. Vanatta.

"Mollusca from Central America and Mexico," by Henry A. Pilsbry.

"Notes on Arachnoidiscus," by Sarah P. Monks.

"Records and Descriptions of Brazilian Orthoptera," by James A. G. Rehn.

"Iron Ore Artifacts from Alabama," by H. Newell Wardle.

"Marine Mollusks of Hawaii, VIII-XIII," by Henry A. Pilsbry.

"Statistical Observations on the Texas Fever Parasite," by Howard Crawley.

"American Dermaptera of the Muséum d'Histoire Naturelle, Paris," by Morgan Hebard.

"A Colombian Pupillid Snail," by Henry A. Pilsbry.

"Ordovician Basalts and Quartz Diabases in Lebanon County, Pennsylvania," by Samuel G. Gordon.

"Marine Mollusks of Hawaii, XIV," by Henry A. Pilsbry.

"Studies on Some Flagellates," by E. Penard.

Nominations for Officers, Councillors, and members of the Committee on Accounts were made.

The deaths of W. Lyman Biddle and Benjamin Smith Lyman, members, were announced.

Edwin B. Bartram, John Cadwalader, 3rd, Francis I. DuPont, Richard Erskine, Samuel G. Gordon, Julian K. Potter, D. W. Steckbeck, Henry F. C. Stikeman, Rodney H. True, and William Chatten Wetherill, were elected members.

The following were ordered to be printed:

MARINE MOLLUSKS OF HAWAII, VIII-XIII.

BY HENRY A. PILSBRY.

The description of material submitted to me for determination by Mr. D. Thaanum, Prof. Wm. A. Bryan and Mr. J. M. Ostergaard, with other forms collected by myself in 1913, is here continued. Former papers of this series were published in these PROCEEDINGS for 1917, pp. 207-230, and 309-333 (1918).

VIII. STYLIFER, ODOSTOMIA, ACTEOCINA

One Hawaiian species, *Stylifer robustus*, was described by Mr. Pease. The Hawaiian species referred to *Scalenostoma apiculatum* Souv. in a former paper¹ is perhaps a *Stylifer* or closely related thereto. It is parasitic or commensal on Echinoderms. Whether it is without an operculum, like the typical Stylifers, has not been noted.

Stylifer deformis Pease, from the Paumotu, resembles both of the Hawaiian forms from the Bryan collection, without exactly matching them. A series of four *S. deformis*, including the figured type, is in the collection of the Academy. They show considerable variation in the degree and direction of curvature of the acuminate early whorls.

Stylifer deformis hawaiiensis n. subsp. Fig. 1a.

Honolulu Harbor, Oahu, collected by W. A. and E. J. Bryan.

The shell is thin, white. The upper fourth is acuminate, of about eight nearly flat, smooth whorls. The rest of the shell, about $6\frac{1}{2}$ whorls, tapers more rapidly; the whorls increase slowly and almost regularly, and are rather strongly convex; and the surface is malleate, having many spiral facets, giving some appearance of having coarse, low, spiral threads on the last two whorls. The last whorl is well rounded basally. The aperture is ovate. Columella is slightly concave.

Length 9.2, diameter 3.2 mm.

¹Proc. A. N. S., Phila., 1917, p. 226.

Only one specimen was obtained. Its host is unknown. The shell tapers more regularly than any of the examples of *S. deformis* seen, and I am inclined to think it a distinct though closely allied subspecies.

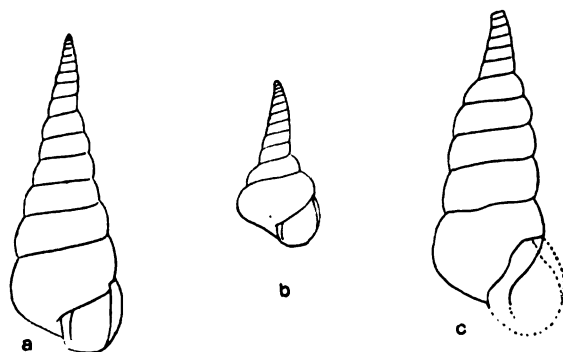


Fig. 1.—a, *Stylifer deformis hawaiiensis*; b, c, *S. deformis remotissimus*.

Stylifer deformis remotissimus n. subsp. Fig. 1 b, c.

Pearl and Hermes Reef. Collected by Lieut. Munter.

The shell is thin, white, polished, consisting of a very narrow, slightly curved early stage of about 9 flat whorls, the shell then abruptly enlarging in the next two whorls, after which it approaches a cylindric form, enlarging slowly to the last whorl, which is a little more dilated. The $5\frac{1}{2}$ whorls of the second stage of growth are convex, the last whorl rounded below. The columella and parietal wall are heavily calloused.

Length 9, diameter 3.5 mm.

As the apex and last half whorl of the largest specimen are broken away, the dimensions given are estimated. A half grown cotype (fig. 1 b) is 4.6 mm. long.

The subcylindric shape of this species is like one of the specimens in Mr. Pease's sending of *Stylifer deformis*, but none of the latter has a heavy parietal callus. This may, however, be a character of old age.

Stylifer mitterlei Petit. Fig. 2 a, b.

The shell is ovate with a very small, narrow apical point, white. The attenuate initial portion consists of 4 somewhat convex whorls. It then enlarges abruptly, the 5 to 6 whorls following being quite convex, glossy, smooth, except for very faint lines of growth. The moderately impressed suture is not margined. The aperture is

ovate, outer and basal margins obtuse. The columella is weakly concave and somewhat thickened. The parietal callus is moderately thick. There is no operculum.

Length 10.6, diameter 6.75, aperture 4.8 mm.

Length 9.2 mm. Smallest adult.

Hilo, Hawaii, on the sea urchin, *Diadema*. D. Thaanum.

The apical point is more or less worn away in the adult stage. A young one, 3 mm. long, is figured showing it perfect. Mr. Thaanum writes that he did not find this *Stylifer* on any other species of sea urchin, though many others were examined.

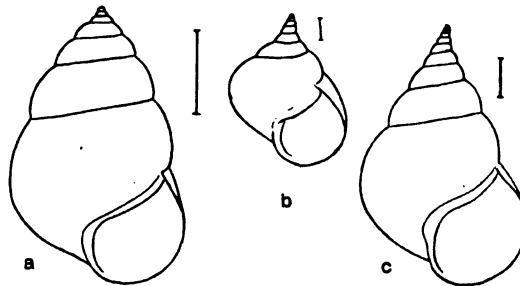


Fig. 2.—a, b, *Stylifer mittrei* Petit, adult and young; c, *Stylifer thaanumi* n. sp.

This form agrees so exactly with that described without definite locality by Petit (Journ. de Conchyl. II, p. 27, pl. 2, figs: 8, 9) that the identity can scarcely be doubted. I am inclined to think that it was a distinct species which Schepman and Nierstrasz¹ had under the name *Mucronalia mittrei* from Sumbawa. It was operculate, 6 mm. long, 4 wide.

Mucronalia tumida Pse., mentioned by Tryon as identical with *S. mittrei*, is certainly distinct from that species.

Stylifer thaanumi n. sp. Fig. 2 c.

The shell is shortly ovate with slender summit, white, glossy and smooth, growth-striae being scarcely noticeable. About 5 early whorls form the slender summit, but the transition to the broad later portion of about 3 whorls is gradual. The last whorl is globose. Suture impressed, not margined. Aperture ovate. Outer and basal lips evenly curved, blunt; columella slightly concave, a little thickened. Parietal callus distinct but rather thin. There is no operculum.

¹ Siboga-Expeditie, Parasitische Prosobranchier der Siboga-Expedition, p. 3.

Length 5.2, diameter 3.4, aperture 2.5 mm.

Hilo, Hawaii, on *Diadema*. D. Thaanum.

Often found with the preceding species.

***Stylifer robustus* Pease.**

Proc. Zool. Soc. Lond., 1860, p. 437.

"Shell globosely ovate, light, polished; finely striated longitudinally; whorls convex and marginated, last whorl swollen, sutures well impressed, inner lip slightly reflected at its junction with the columella and around the base, disappearing at about the center of the outer lip. Color white. Lives on Echini." Sandwich Islands.

This species is not contained in the Pease collection, Museum of Comparative Zoology. The description does not apply well to any specimens I have seen, and without measurements or figure it can hardly be recognized.

***Odostomia (Chrysallida) hiloensis* n. sp. Fig. 3.**

The shell is ovate-conic, solid, white, nuclear whorl smooth, convex, with inturned apex; next whorl very indistinctly plicate axially. The whorls of the spire are nearly flat. Suture channelled. Last whorl is more convex, with sculpture of spiral furrows, unequally

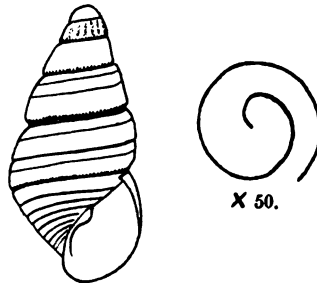


Fig. 3.—*O. hiloensis*, with outline of apex.

spaced, a deep one just below the periphery, three less impressed grooves above it, the middle one deepest; below it are 7 or 8 spirals the lower three but little impressed. The aperture is ovate, columellar plait strong.

Length 2.1, diameter 1.05, aperture 0.85 mm.; $5\frac{1}{2}$ whorls.

Hilo, Hawaii. D. Thaanum.

Near *O. stearnsiella*, but this is smaller and differs in details of sculpture. How constant the groove patterns are in these small shells remains to be seen.

Acteocina hawaiiensis n. sp. Fig. 4.

The shell is minute, cylindric, white with several spiral series of gray spots. The spire is moderately raised, of very convex whorls parted by a deep suture. The initial whorl is prominent, tilted on edge, smooth; following whorl very narrow. There are three post-embryonic whorls. The last whorl is strictly cylindric, shouldered below the suture, with rather coarse wrinkles of growth. The columella is straightened above, excavated or obliquely truncate below. Outer lip arches forward.

Length 2.35, diameter 1 mm.

Off Launiupoko Camp, near Lahaina, West Maui, in 25-75 feet. Thaanum and Langford. Type 127746 A. N. S. P.

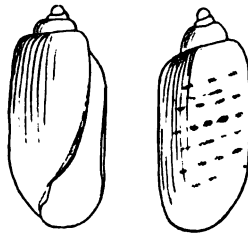


Fig. 4.—*Acteocina hawaiiensis*.

Smaller and more straightly cylindric than other known Hawaiian *Acteocinas*, further distinguished by the rather strong sculpture and the gray spots. Five series of these are seen in the type, seven in another example. They are chiefly visible on the back. All of the specimens sent are "dead" shells; one, somewhat defective, is a little larger and relatively wider than those figured.

IX. TEREBRA

Pease's notes on Hawaiian species may be found in Amer. Journ. Conch. IV, pp. 123-125, and V, 86. There are no examples of his *Terebra assimilis* Pse. (= *T. contigua* Pse., 1871) in the Pease collection, Museum of Comparative Zoology.

T. swainsoni Dh. has been discussed by Pease, who described a var. *inflexa*, to which he referred Reeve's figure 118, of *swainsoni*. I believe the figure was drawn from the latter species, of which Pease's *inflexa* becomes a synonym. It is rather common off the south coast of Oahu. It differs from *T. nitida* and *phcatella*, which are very closely allied, by having fine spiral striae in the interstitial intervals. The inner lip forms a raised ledge as in *T. nitida*. The

color ascribed to *T. swainsoni* by Deshayes and Reeve is that of faded beach shells. Twenty specimens examined, in coll. A. N. S. P. and M. C. Z.

Terebra sulcata Pease (Amer. Journ. Conch. V, p. 67, from Oahu) appears to be merely a small form of *swainsoni*, with stronger spiral sculpture, approaching that of *T. rosacea* somewhat. The specimens seen are No. 49967 M. C. Z., agreeing exactly with 117036 P. A. N. S., from 6-8 fathoms, off Honolulu. D. B. Langford.

Pease stated that he had 32 species of *Terebra* from the Hawaiian Islands. The following species are before me, in addition to several not determined.

T. chlorata Lam. Midway Island.

T. crenulata fimbriata Lam. Kahuku, Oahu.

T. gouldii Desh. Off Honolulu.

T. inconstans Hinds. Off Diamond Head, etc., Oahu; Molokai; Kauai.

T. inconstans confusa Smith. Off Halawa, Molokai.

T. lauta Pse. Off Honolulu; Mokapu Point, Oahu.

T. nitida Hinds.* Off Honolulu.

T. nodularis Desh.* Honolulu Harbor, Kaneohe Bay.

T. pertusa Born. Off Honolulu.

T. propinqua Pse. Off Honolulu and Waikiki.

T. rosacea Pse. Off Honolulu.

T. suffusa Pse. Off Honolulu.

T. swainsoni Desh. Off Honolulu.

T. venosa Hinds. Off Honolulu; Kauai; Maui.

T. verreauxi Desh. (*T. strigilata* of Born and Lamarek, not of Linné). Off Honolulu; Haena, Kauai.

Partial Key to Hawaiian *Terebra*.

1. No groove defining a presutural band; smooth ribbed, without spiral sculpture 2
 A presutural band defined by a groove or series of pits, at least in the upper half of the shell 5
2. Aperture dilated below; no canal, the emarginate base broad. *T. inconstans* Hinds.
 Aperture not dilated below, the base narrow, somewhat channelled 3
3. A series of dark spots on or below a whitish band at the suture. *T. verreauxi* Desh.

*The specimens appear to be intermediate between *nitida* Hinds and *plicatella* Desh., possibly referable to the latter.

*This is quite distinct from *T. textilis* Hinds, with which Tryon unites it.

- Spaced brown axial lines on a pale ground; ribs extending from suture to suture as far down as the penult whorl; 38×6.4 mm.
T. lanceata oahuensis n. subsp.
- White bands at suture and below periphery, a broad band of brown streaks or blotches above periphery, a narrow one at the base, apex purplish; ribs very fine, retracted at suture..... 4
4. 20×5 mm.; Honolulu..... *T. medipacifica* n. sp.
 28×7 mm.; Kaneohe Bay..... *T. m. melior*, n. subsp.
5. Presutural band defined by a series of transverse pits or punctures..... 6
 Presutural band defined by a groove, at least on the upper half of the shell..... 10
6. Ribs and intervals smooth..... 7
 Intercostal intervals below the presutural band transversely grooved..... 21
7. Inner lip callous and raised; ribs strong..... 9
 Inner lip not raised..... 8
8. Ribs straight, strong and subangular; brownish (fading to pinkish), paler below the suture..... *T. clappi* n. sp.
 Ribs low; whitish, or with a dull purplish band. Marked with flexuous axial brown lines..... *T. venosa* Hinds.
9. A series of dark spots below the suture..... *T. lauta* Pse.
 Color nearly uniform..... *T. nitida* Hinds.
10. Whorls flat; no sculpture except the groove..... 11
 Whorls having other sculpture..... 12
11. 60 to 75 mm. long; maculate..... *T. chlorata* Lam.
 30 to 35 mm. long; pale fleshy..... *T. suffusa* Pse.
12. Without spiral sculpture below the presutural groove..... 13
 Having spiral sculpture below presutural groove..... 17
13. Presutural band nodular, the later whorls elsewhere nearly smooth; large; with a few series of dark dots..... *T. crenulata* (L.).
 Presutural band with numerous ribs..... 14
14. Last whorl nearly smooth below the band, with 4 rows of faint spots on a whitish ground; earlier whorls ribbed; whorls shorter, less oblique than in *T. argus*. 40×8 mm., 12 whorls.
T. argus brachygyra n. subsp.
- All whorls ribbed..... 15
15. Inner lip not callous; length 60 to over 70 mm..... 16
 Inner lip callous throughout; whitish with fleshy intercostal intervals and three faint gray spiral lines on last whorl; peristome retracted above a point at termination of sulcus. Similar to *T. cerithina* Lam., but costate throughout. 29.5×6.9 mm., 12 whorls..... *T. spaldingi* n. sp.
16. Diameter contained about $4\frac{2}{3}$ times in length; maculate.....
T. gouldii Desh.
 Diameter about $4\frac{1}{3}$ times in length; no distinct pattern of color; last whorl much more convex and more contracted below than *T. gouldii*; 60×13.5 , aperture 14 mm., 12 whorls remaining..... *T. thaani* n. sp.

17. Presutural band and surface below it axially ribbed.....18
 Band and surface below it striate, not axially ribbed; band very convex, narrow, a cord and several smaller spirals below it; ochraceous-buff; long, slowly tapering; 41 x 7.9, aperture 7.2 mm.; 23 whorls.....*T. langfordi* n. sp.
18. A tubercular cord below the presutural band, causing it to appear double.....19
 No cord below the presutural band; surface with spiral grooves in the intercostal intervals.....19
19. Pale buff; about 27 x 5 mm.....*T. nodularis* Desh.
 White with three series of tawny dots on last whorl below the band; columella biplicate; a recurved basal channel; 30 x 6.7 mm., 17 whorls.....*T. waikikiensis* n. sp.
20. Tawny, with whitish streaks on band.....21
 White, with 3 series of tawny dots on the last whorl, presutural band white; below the band there are 3 or 4 spiral cords separated by deep impressions across the intercostal intervals, the upper cord widest; columella distinctly biplicate; a recurved basal channel; 30 x 6.7 mm., 17 whorls.....*T. waikikiensis* n. sp.
21. Small, slender forms with raised inner lip and rather fine spiral striae in the intervals of the strong ribs.....*T. swainsoni* Dh.
 Inner lip not raised; intervals spirally grooved.....22
22. Tawny, irregularly marked with whitish streaks; presutural band marked with purplish-brown between the white ribs; 50-60 mm. long.....*T. pertusa* Born.
 Tawny, ribs white on the presutural band; 30-35 mm. long.....*T. propinqua* Pse.
 Smaller; pale, with 3 ochraceous-buff bands; presutural ribs white, some of the intervals brownish; intercostal spirals finer, 10 on penult whorl, aperture somewhat channelled and yellow below. 25 x 5.5, aperture 5.3 mm.; 15 whorls. Maui and Oahu.....*T. flavofasciata* n. sp.
 Small, length about 20 mm.; roseate and whitish, without distinct pattern.....*T. rosacea* Pse.

Terebra langfordi n. sp. Pl. XII, fig. 5.

A long, slowly tapering species similar to *T. straminea* in appearance; light ochraceous buff in color. The whorls are short; presutural fasciole a strong cord, its upper slope somewhat grooved; below it a much smaller cord followed by four (rarely three) unequal spirals, traversed by unequal arcuate incremental striae. Base of the last whorl with numerous smaller spirals. The aperture is small, with strongly oblique anterior canal. Columella short, smooth.

Length 41, diameter 7.8, aperture 7.2 mm.; 23 whorls.

Length 50, diameter 9, aperture 8.2 mm.; 21 whorls, apex broken

Off Honolulu in 6 to 8 fms. D. B. Langford.

In *T. straminea* the presutural band and the cord following it are obliquely costulate, the presutural band flattened. Otherwise it is much like the present species. *T. funiculata* Hinds is more closely related. It is decidedly more slender than *T. langfordi*, with more spiral threads, one at the periphery more prominent.

A form of which I found a single specimen on the dredger dump at Honolulu is much more slender. The groove dividing the sutural band is deeper, and there are but three spiral cords below the one accompanying the band. In the small number of spirals it differs from *T. funiculata*. This form may be called *T. langfordi angustior* (Pl. XII, fig. 6.)

Length 29, diameter 5, aperture 4.5 mm.; 20 whorls remaining.

I at first thought this form was *T. sculptus* Pease, but that is described as having a conspicuous nodose rib.

The spiral sculpture is much more pronounced than in *T. laevigata* Gray.

***Terebra argus brachygyra* n. subsp. Pl. XII, fig. 4.**

The shell is smaller than *T. argus* with shorter, less oblique whorls; the sculpture of low ribs cut by an irregularly punctured spiral sulcus is stronger, and visible down to the penult or even on the last whorl. The pattern of three series of squarish pale buff spots on an almost white ground is very indistinct.

Length 40, diameter 8 mm., 12 whorls remaining, the apex broken.

Length 39, diameter 8.7 mm., 12 whorls remaining.

Off Honolulu, 3 to 8 fms. D. Thaanum.

***Terebra peasei* Desh.**

This species of the section *Strioterebrum* has been considered a synonym of *T. puncticulata* by Reeve. Pease (Amer. Journ. Conch. V, p. 64) concurs in this synonymy. The locality of *T. puncticulata* was unknown. The description agrees well with the Hawaiian species except for the phrase "*plicis regularibus, depressis, latis, obtusis*" and the statement that the whorls are "*subaequaliter divisus*" by the presutural line.

In the Hawaiian shell the folds could not be called wide, and the division of the whorls is well above the middle.

Reeve's figure of *T. puncticulata* evidently represents the type of *T. peasei*, agreeing with that, and not with *puncticulata*, in measurements.

Under the circumstances it appears safer to call the Hawaiian form (which has been taken by Langford off Honolulu in 6 to 8 fathoms) *T. peasei* Desh. Two lots from Pease are in the collection of the Academy.

Terebra flavescens Desh. (P. Z. S. 1859, p. 299; Reeve, C. Icon. XII, pl. 14, fig. 59) does not appear to differ much from *T. peasei* Desh., except that the axial ribs are arcuate. I have not seen it. Locality, Sandwich Islands, Cuming coll.

***Terebra thaenumi* n. sp.** Pl. XII, figs. 1, 2.

A shell resembling *T. gouldii* Desh.; the whorls shorter than in that species, especially the last whorl, which is much more convex; aperture shorter. It is pinkish buff with ill-defined streaks of cinnamon or russet. The sides are straight. The suture and the furrow defining the presutural fasciole are subequal, deeply impressed, the surface narrowly shouldered, subangular below both. The presutural band occupies somewhat more than one-third of each whorl. Sculpture of smooth ribs equal to their intervals, about 30 on the penult whorl. No interstitial spiral sculpture. The last whorl contracts abruptly below, the base well rounded, separated from the siphonal fasciole by a furrow bounded below by a sharp ridge. The aperture is subtrapezoidal. Columella straight, obliquely truncate.

Length 60, diameter 13.5, aperture 14 mm.; 12 whorls, the apex broken. Type.

Length 51, diameter 10.7, aperture 12.3 mm.; 18 whorls, apex perfect.

Off Honolulu in 6 to 8 fms. D. B. Langford. Also off Waikiki in 25 to 50 fms.

By conchological criteria this would probably belong to *Dupli-caria*; yet until the teeth of many more species of *Terebra* are examined, no classification of the species has much value.

***Terebra waikikiensis* n. sp.** Pl. XII, fig. 12.

The shell is slender, slowly tapering, white, with three spiral series of chestnut dots on the last, two on the preceding whorls; these dots are also in vertical series, of which there are about 8 on the last whorl. Sculpture of rounded axial ribs equal to their intervals, about 21 on the last whorl. The ribs are deeply sinuated by the presutural groove, which is rather deep between them, and defines a wide presutural band. Below the groove there are three or four furrows across each intercostal interval, and above, near the suture there is one such furrow. The last whorl is convex with numerous spiral

cords. Aperture small, the anterior canal recurved. The columella is biplicate within.

Length 30, diameter, 6.7, aperture 6 mm.; 17 whorls.

Off Waikiki, Oahu, in 25 to 50 fms. D. B. Langford.

In form and color somewhat like *T. decorata* Desh. (Proc. Zool. Soc. 1859, p. 314, no. 214), which is said by Reeve to be identical with *T. tessellata* Gray (P. Z. S. 1834, p. 61); but that species is entirely distinct in sculpture.

***Terebra flavofasciata* n. sp.** Pl. XII, fig. 3.

Shell shaped like *T. propinqua* Pse.; white, part of the intercostal spaces of the presutural band marked with vinaceous russet; 3 ochraceous-buff bands, one below the sutural band, another narrow, at the periphery, and the third occupying the base. Sculpture of smooth, rounded axial ribs, slightly wider than their intervals, 19 on the last whorl of the type, 25 mm. long, (16 in a shell 17 mm. long). The intercostal intervals have many spiral cords wider than their interstices, 10 on the penult whorl, below a series of deeper transverse pits defining the presutural band. Upon the band the interstitial spirals are finer. On the base the ribs become obsolete and there are coarser spiral cords. Aperture rhombic, somewhat channelled and yellow at the base.

Length 25, diameter 5.5, aperture 5.3 mm.; 15 whorls.

Off Launiupoko camp, West Maui; small specimens, 17-18 mm. long, off Honolulu, 6 to 8 fms. D. Thaanum and D. B. Langford.

Smaller than *T. propinqua* and *T. pertura*, with more numerous spirals and different coloration. Possibly to be compared with *T. sulcata* Pease (Amer. Journ. Conch., V, 67), the type of which is lost.

***Terebra clappi* n. sp.**

The shell is slender, shaped about as in *T. nitida*, glossy, dark vinaceous brown, the ribs and an ill-defined belt below the suture paler or whitish. Whorls nearly flat, with well-impressed suture, the last whorl contracting downward. Sculpture of straight, angular ribs, rather suddenly terminating at the base, the intervals having a spiral series of impressions defining an infrasutural band; these impressions sometimes nicking the summits of the ribs slightly. In the type there are 15 ribs on the last whorl. The aperture is a little dilated below. Columella one-folded.

Length 17.5, diameter 3.8, aperture 4.2 mm. 11 post-embryonic whorls.

Length, 21, diameter 4.5 mm., 13 post-embryonic whorls. Honolulu, Pease Coll., M. C. Z., 49964.

Off Mt. Lihau, West Maui, 25-75 feet., D. Thaanum. Also off Honolulu, 35-50 feet., D. B. Langford.

This species differs from *T. nitida* by the absence of a raised inner lip, though it is often somewhat calloused. It is much like *T. swainsoni*, as I have identified that species, but lacks the interstitial sculpture and the raised inner lip of that species. Seventeen specimens in coll. A. N. S. P. and M. C. Z.

It appears to be what Pease identified as *T. swainsoni* Desh., but that is described as having the early whorls transversely striate.

It is named for Mr. Wm. F. Clapp, who has kindly assisted in the examination of Pease's species.

***Terebra lanceata oahuensis* n. subsp. Pl. XII, fig. 7.**

The shell is rather smaller than *lanceata* and for at least half of its length the ribs extend entirely across the whorls; on the later whorls they shorten, but are visible below the suture on the last. The pattern of brown lines, interrupted or bent at the periphery, is similar to that of *lanceata*.

Length 38, diameter 6.4 mm.

Off Honolulu, 6 to 8 fathoms. D. B. Langford.

Dr. Dall (Bull. M. C. Z., 43, p. 249), has formed a subgenus *Acumina* for *Terebra lanceata* (Linné); but that species is conchologically close to *T. strigilata* of Born and Lamarck, and would seem to belong to *Hastula*.

***Terebra verreauxi* Desh.**

Journ. de Conchyl., II, 1857, p. 95, pl. 5, fig. 3.

Exactly what species was intended by *Buccinum strigilatum* Linné (Syst. Nat. X, p. 741; Hanley, Ipsa Linn. Conch. p. 261) is not known. As Hanley remarked, the identification of Born has been generally accepted.⁴ He states that the shell in Linne's cabinet is *T. concinna* Desh.

For the Hawaiian form we prefer to use the name given by Deshayes, whose description and figure represent this form. It is one of the most beautiful of the genus. The color is from deep olive to ecru-olive or more ochraceous, with white bands at suture and below periphery, the former decorated with regular black-brown spots. It has been taken off Honolulu, 6-8 fms (D. B. Langford), and at Haena, Kauai (Bryan).

⁴Also by Melvill and Standen in their revision of Persian Gulf Terebridae, Journ. of Conch., XV, 212.

***Terebra medipacifica* n. sp.** Pl. XII, figs. 8, 9, 10.

Shell rather slender with slightly convex lateral outlines; a white band below the suture, followed by a broad band of brown streaks and blotches on a white ground, extending to the periphery. A second white band below the periphery and a narrow band of brown markings just above the narrow, rather shallow furrow between base and siphonal fasciole; apical whorls purplish. Sculpture of fine, forwardly curved axial ribs, about 35 on the last whorl. Both ribs and intervals are smooth, there being no spiral sculpture. There are about $4\frac{1}{2}$ smooth embryonic whorls, the last bulging, wider than the following sculptured whorl; $8\frac{1}{2}$ sculptured whorls. Suture is regularly crenulated by the ends of the ribs. The aperture is narrow, channelled above by the retraction of the lip near its insertion. Anteriorly it is broadly notched. Columella smooth. There is no raised inner lip, though the parietal callus is rather thick.

Length 18.8, diameter 4.4, aperture 5.4 mm.

Length 20, diameter 5, aperture 6 mm.

Off Honolulu, 6 to 8 fathoms. D. B. Langford.

It is much more finely ribbed than *T. inconstans*, with a differently shaped aperture. *T. bipartita* Desh. (Proc. Zool. Soc. London, 1859, p. 284), from the Isles Sandwich, requires comparison, but the description does not agree fully, and the species has not been figured.

It is one of the species which Reeve and Tryon would have placed under *T. hastata*.

***Terebra medipacifica melior* n. subsp.** Pl. XII, fig. 11.

A much larger form of this species was taken in Kaneohe Bay, Oahu. The brown markings are much reduced, but not more than in some Honolulu shells. There are 38 ribs on the last whorl.

Length 28, diameter 7, length aperture 8 mm.; 10 post-embryonic whorls.

***Terebra spaldingi* n. sp.** Pl. XII, fig. 13.

Shell narrow, polished; whitish, the intercostal intervals flesh colored; three faint gray spiral lines on the last whorl, the upper one visible on the spire.

Sculpture of smooth, rounded axial ribs, about 22 on the last or penult whorls, a little prominent just below the suture, interrupted by a well impressed presutural groove; intervals smooth. Last whorl with a spiral ridge bounding a narrow basal furrow, which extends also above the narrowly reflected basal margin. The aper-

ture is rather wide below, posteriorly channelled, the outer lip retracted a little above. Inner lip calloused, a little elevated. No columellar fold.

Length 29.5, diameter 6.9, aperture 7.5 mm. Twelve whorls.

Off Honolulu, 6 to 8 fathoms. D. B. Langford.

A form from Kaneohe Bay in 4 fathoms is much larger, length 37.3, diameter 9 mm.

This species is closely related to *T. cerithina* Lam., but differs in having all of the whorls ribbed. The Honolulu specimens are stained with iron. *T. affinis* Gray differs by the interstitial sculpture.

***Terebra dussumieri hiradoensis* n. subsp.**

The shell is similar to *T. dussumieri* in form, but differs by the smaller number of longitudinal ribs, which are wider and more widely spaced, about 17 on the penult whorl.

Length 55, diameter 11 mm.

Hirado, Hizen, Japan. Type 81994, A. N. S. P.

X. MITRA AND VEXILLUM

W. H. Pease described several forms about which little is known. His notes on various Hawaiian species were published in the American Journal of Conchology, III, pp. 212-215, 233, 271; IV, pp. 119-121; V, 85.

Mitra mitra (L.) (*Voluta mitra episcopalis* L.) has been taken in the material dredged from Honolulu Harbor, but no specimens are at hand for comparison with those of other localities.

Partial Key to Hawaiian Species of Mitra and Vexillum.

- I. MITRA. Shell smooth, finely striate, or with spiral punctured lines; throat not lirate.
 1. Shell with spiral series of spots on a light ground..... 2
 Shell uniform or otherwise marked..... 3
 2. Six spiral series of orange spots; large, the last whorl smooth.
M. mitra (L.).
 Three irregular series of brown (tawny) spots; finely striate spirally throughout; outer lip thin near the upper insertion, elsewhere rather thick and smooth, a low swelling behind it. 6 plaits; base recurved. Aperture longer than in *M. ustulata* Rve.; 50 x 15, aperture 26 mm.....
M. kamehameha n. sp.
 3. Suture crenulated by a series of white tubercles..... 4
 Suture even or nearly so 6

4. Weakly, irregularly plicate, with coarse punctures in spiral and axial series 5
 Not plicate; fine punctures in spiral series, often obsolete at periphery; a ragged or blotched white band near the suture and usually other white spots, on a dark ground.
M. coronata aurora Dohrn.
5. Chocolate, with a white band bordering the suture.
M. lugubris Sw.
 A narrow whitish band a short distance below the suture, white sutural tubercles. Honolulu.
M. lugubris honoluluensis n. subsp.
6. Spire and upper part of last whorl finely axially costulate, with spiral punctured lines 7
 Spire spirally striate, not distinctly costulate 9
7. Aperture $\frac{2}{3}$ or more of the total length; spire short; yellow (or white) with dark apex and basal spot 8
 Aperture less than $\frac{2}{3}$ of the length, spire moderately long; white with a dark brown median belt *M. newcombi* Pse.
8. Last whorl sculptured only at the upper part.
M. olivaeformis Sw.
 Last whorl having spaced, closely punctate spiral lines throughout, otherwise similar to the preceding.
M. olivellaeformis n. sp.
9. Fusiform, the aperture half the length or less 10
 Pupiform, with shorter spire and longer aperture 14
10. Small species, less than 18 mm. long 12
 Larger or large species, about 20–50 mm. long 13
12. White, smooth, with two wide orange zones; about 14 mm. long *M. micans* Rve.
 White; minutely striate spirally, 7–8 mm. long.
M. alba Pse.
13. Uniform cinnamon-brown; outlines rather straight above and below the convex periphery; sculpture of punctate spiral lines, 8 on penult whorl, weaker in the peripheral region; outer lip contracting above, with crenulate edge, but without any internal tubercle or callus; 6 plaits. 51 x 19, aperture 24.4 mm., 8 whorls *M. thaaniumiana* n. sp.
 Similar to the preceding, but the last whorl is somewhat flattened peripherally; there are 6 punctured lines on penult whorl; irregular crenulations below the suture; 5 plaits. 43 x 15, aperture 22.3 mm. Orange (faded); Honolulu.
M. ostergaardi n. sp.
 Olivaceous or dusky, with widely spaced dark spiral lines; outer lip thickened or with a tubercle within.
M. astricta Rve.
14. Speckled with buff on a dark ground *M. litterata* Lam.
 Chocolate, with a pale shoulder band *M. auriculoides* Rve.
 Uniform dark brown 15

15. A callous projection within the outer lip in adult shells, none in the throat; peripheral region convex; 5 well developed plaits..... *M. brunnea* Pse.
 No lip callus; a nodule in the throat; carob brown to chestnut brown, the aperture chocolate; last whorl somewhat cylindrical, smooth with spirals at the base; 4 plaits. 25 x 10.4, aperture 14 mm..... *M. ticaonica vagans* n. subsp.
- II. Shell conspicuously spirally lirate, axial sculpture subordinate or wanting; outer lip blunt or thin, crenulate, throat smooth.
1. Diameter nearly half the length; with smooth spiral cords, very little interstitial sculpture 2
 Shell more slender, with distinct interstitial sculpture 4
2. Shell irregularly plicate axially; very pale with a thin brown epidermis..... *M. turgida* Rve.
 Shell not plicate 3
3. Orange, often with white peripheral maculation.....
M. tabanula Lam.
 Thin, fulvous..... *M. subrostrata* Sowb.
 Brown with some white maculation..... *M. proscissa* Rve.
 White, variegated with smoky brown..... *M. pudica* Pse.
4. Interlirral spaces with an intermediate thread and close axial sculpture leaving narrow pits..... *M. interlirata* Rve.
 Having close low riblets, making the cords tubercular; 11 cords on last whorl; yellowish with 2 indistinct brown bands, tubercles white; 3 columellar plaits. 11.6 x 4.5, aperture 6.3 mm..... *M. waikikiensis* n. sp.
 Having spaced axial impressed lines throughout; apex pink; 4 or 5 plaits.
5. Spirals narrow, brown on a white ground; smaller than *M. granatina* Lam., the brown lines continuous; 35.3 x 11.4, aperture 18 mm.; 8 post-embryonic whorls; Honolulu.....
M. langfordi n. sp.
- Spirals blunt, alternately larger and smaller; buff with a broad chestnut peripheral band, its upper half interrupted into a series of large spots; 29.3 x 9.3, aperture 16.4 mm.; 7½ post-embryonic whorls; near *crenifera* Lam., but smaller with many more impressed axial lines..... *M. emersoni* n. sp.
- III. VEXILLUM. Axial ribs predominating over spiral sculpture when the latter is present. (In *baldwini* the later whorls are smooth.)
1. Shell obesely fusiform, with narrow aperture; outer lip conspicuously receding or excised below, lirate within, a plait at its upper third; 5 or 6 plaits (Section *Idiochila*, new)..... 2
 Outer lip normal, not receding below..... 3
2. Last 3 or 4 whorls very smooth and glossy, marbled or streaked; early whorls costulate..... *V. baldwini* Melv.

**V. baldwini* has been collected at Honolulu by Ostergaard and Bryan. It may prove to be identical with *V. flammulata* Pse., of which I have not seen specimens. *V. baldwini* and *V. turben* form a peculiar section to be called *Idiochila*, the type being *V. turben* Reeve.

surmounted by a cinnamon line; 11 rounded ribs on the last whorl, intervals with transverse impressions, 10 or 11 in intervals on penult whorl; 5 plaits, 25.3 x 8, aperture 12 mm.; 10 whorls.....*V. thaanumi* n. sp.
 Fusiform, white with a chestnut band below the periphery and few blackish-brown spots below the suture, apex dark brown, 22 smooth axial ribs on last whorl with short, transverse impressions in the intervals, 6 in each interval on penult whorl; 2 spiral cords more prominent at base; 5 thin plaits. 18 x 7.5, aperture 8.4 mm.; 10 whorls.....*V. xenium* n. sp.

Mitra kamehameha n. sp. Pl. XII, fig. 23.

The shell is slender, fusiform, finely striate spirally. White, with three series of ochaceous orange spots, subsutural, peripheral and basal, the former with few spots. On the spire these spots are more or less con crescent into longitudinal stripes.

The last whorl has a broad swelling behind the outer lip. The aperture is more than half the total length, narrow. Outer lip is rather thick, excavated within and becoming quite thin near the upper insertion. There are six plaits, the lower ones small.

Length 50, diameter 15, aperture 26 mm. Type.

Length 40, diameter 12.7, aperture 22 mm.

Honolulu Harbor, in the dredger dump. J. M. Ostergaard.

This species is related to *M. ustulata* Rve., but it differs by having the aperture longer, more than half the total length, while in *ustulata* it is less than half. The color is doubtless darker in living specimens.

Mitra thaanumiana n. sp. Pl. XII, fig. 21.

The shell is solid, fusiform. Outlines of spire and basal part straight, periphery convex; cinnamon-brown, where the thin cuticle is lacking, sayal brown, the apical whorls paler. Sculpture of fine, well-spaced spiral striae marked with series of small punctures, and separated by flat intervals; on the back of the penult whorl there are 8 such spirals. The basal third of the last whorl has coarser, deeper spirals and punctures, with convex intervals. The aperture is clouded with cinnamon within. It is widest in the lower part, the lip being straight and abruptly contracted above. There are six white plaits.

Length 51, diameter 19, aperture 24.4 mm. Eight whorls (the apex worn.)

Hilo, Hawaii, D. Thaenum.

Mitra ostergaardi n. sp. Pl. XII, fig. 22.

The shell is fusiform with conic spire somewhat flattened periphery, somewhat convexly tapering base, slightly concave below; ochraceous-buff to nearly as dark as ochraceous-orange, the spire usually a little paler. Sculpture of widely-spaced spiral series of small punctures, six on the back of penult whorl, the intervals very minutely, superficially striate spirally; towards the base having punctured spiral grooves. Under the suture the whorls are a little prominent and finely, irregularly crenulate.

The aperture is flesh-tinted within; narrow, but slightly wider below; lip contracted above. Five plaits.

Length 43, diameter 15, length aperture 22.3 mm. (summit broken).

Honolulu Harbor, in the dredger dump. J. M. Ostergaard.

The color is altered, as in nearly all shells from the "dump," in life it will be found to be much darker in color. It is closely related to *M. tha anumiana*, but the last whorl is decidedly more cylindric, and there are fewer spiral puncture lines.

Two of the three specimens show a very faint pale line at the shoulder. Some young shells which are perhaps this species have a distinct whitish line at the shoulder, They have 4 columellar plaits.

Mitra coronata aurora Dohrn.

Faded specimens are found in the dump of the Honolulu Harbor dredge. Also taken alive in 150-300 feet off Waikiki by D. B. Langford. Mr. Thaanum collected beautiful living ones at Keekea, Hilo, Hawaii.

Mitra lugubris Swains.

Honolulu Harbor; off Waikiki, 35-50 fms.

Mitra lugubris honoluluensis n. subsp. Pl. XII, fig. 16.

Similar to *M. lugubris* in the deep punctures and longitudinal wrinkles, but having small, white subsutural tubercles and a narrow white band a short distance below the suture.

Length 23, diameter 9.7 mm.

Honolu'u Harbor.

Mitra (Strigatella) ticaonica vagans n. subsp. Pl. XII, figs. 14, 15.

The shell is oblong, solid. Chestnut-brown. Spire short, with sculpture of five impressed spiral lines. Last whorl smooth except at the base, where there are about 10 spiral furrows.

The aperture is long and narrow, dark brown within, the outer lip contracted above, having a deeply placed median fold in the throat. Columellar plaits whitish, four, sometimes with a short tubercle between the first and second.

Length 25, diameter 10.4, length of aperture 14 mm.

Length 22.5, diameter 10, length of aperture 12.3 mm.

Hilo, Hawaii. D. Thaanum. Also collected on the Honolulu Harbor dump in considerable quantity by Prof. Wm. A. Bryan several years ago, and by the writer in 1913.

Hawaiian examples have the spire less deeply grooved, and the last whorl more extensively smooth than *M. ticaonica* Reeve of the Philippines. They appear to be worthy of varietal separation.

Strigatella fuscescens Pse. (Proc. Zool. Soc., 1860, p. 146; Amer. Journ. Conch., III, 233) differs by the white aperture and 5-plaited columella.

The Honolulu specimens have faded to a tawny or ochraceous buff tint. The largest measures, length 31, diameter 11.3, aperture 15 mm. (fig. 14).

***Mitra olivellaeformis* n. sp.**

The shell is similar to *M. olivaeformis* Sw. except that it is more slender, and the entire last whorl is provided with impressed, punctured spirals, about 13 on the last whorl.

Length 11.2, diameter 4.7 mm. Type, Niihau.

Length 15, diameter 5.6 mm. Viti Islands.

Niihau. Type 67779 A. N. S. P.

The typical *M. olivaeformis* Swains.⁶ has two or three puncture series about the summit of the last whorl. It has been found in Honolulu Harbor by Prof. W. A. Bryan, who gave me a specimen.

***Mitra langfordi* n. sp. Pl. XII, fig. 20.**

Closely related to *M. granatina* Lam. (*M. scabriuscula* L., of Reeve and Tryon), but constantly smaller, with smaller secondary spirals and several fine striae in the intervals between major spirals; of the latter there are five on the penult whorl, with a smaller one above, near the suture; the brown lines of these spirals are continuous or nearly so (while in *granatina* they are much interrupted). Columella with four or five plaits. The embryonic stage, of about 3 whorls, is smooth and pink.

Length 35.3, diameter 11.4, length of aperture 18 mm; 8 post-embryonic whorls.

⁶Zoological Illustrations II, second series, 1831, Mitranæ, pl. 6, fig. 3.

Off Honolulu, D. B. Langford.

The shell is less elongate than *M. gracilis* Reeve, and is more closely related to *M. granatina* than to the *M. filosa* complex.

Voluta filaris L. (Mantissa p. 548, 1771) is not positively identified, though the opinion of Hanley that it is identified with *M. filosa* Lam. (not Born), (Kiener's pl. 5, figs. 12), seems probable.

M. filosa Born (+ *M. nexilis* Martyn) and *M. bernardiana* Phil. appear to be distinct and valid species. *M. circula* Kiener ("circulata" of Reeve and Tryon) is also quite distinct. None of these has been taken in Hawaiian waters so far as I know.

***Mitra emersoni* n. sp.** Pl. XII, fig. 19.

A species closely related to *M. crenifer* Lam.;⁷ smaller; the vertical impressed lines about twice as far apart.

The shell is buff with a broad, irregular peripheral band of chestnut, its upper half interrupted into a series of large spots; also an indistinct, brown band composed of spots and dashes at the base.

Sculpture of alternately smaller and larger spirals and well-spaced, vertical, impressed lines. Four plaits. Embryonic shell pinkish.

Length 29.3, diameter 9.3, aperture 16.4 mm. Seven and one-half post-embryonic whorls.

Off Honolulu. D. B. Langford.

Named in honor of Mr. Joseph Emerson of Honolulu.

Mitra pallida Pse. (Proc Zool Soc. London, 1860, p. 146) has not been described with sufficient detail for recognition.

***Mitra waikikiensis* n. sp.** Pl. XII, fig. 17.

The shell is fusiform, pale brown with ill-defined darker peripheral and basal bands and white tubercles. Sculpture of spiral cords (eleven on the last whorl behind the lip) and lower longitudinal ribs, producing tubercles where they cross the cords. Aperture white. Columella with three plaits, the upper large, the lower quite small.

Length 12.5, diameter 4.8, length of aperture 6.7 mm.

Length 11.6, diameter 4.5, length of aperture 6.3 mm.

Off Waikiki, Oahu, in 35-50 fms. D. B. Langford.

***Vexillum thaenumi* n. sp.** Pl. XII, fig. 31.

The shell is fusiform, rather slender, white, with a cinnamon band below the periphery. At the periphery there are narrow vin-

⁷Which perhaps = *M. clathrus* (Gmelin), but the figure of that is very unsatisfactory.

aceous or brownish spots between the ribs, surmounted by a continuous, cinnamon line. On the penult whorl this line is median.

Sculpture of vertical ribs weakening towards the base, the intervals with short impressed lines in a spiral direction; on the last whorl there are 11 ribs and about 19 spirals, exclusive of those on the siphonal fasciole. On the penult whorl there are 10 or 11 impressions in an interval.

The aperture is slightly pink tinted within, lirate in the throat. Five columellar plaits, the lower one very small.

Length 25.3, diameter 8, aperture 12 mm.; 10 whorls.

Off Waikiki, Oahu, in 200-300 feet. D. B. Langford.

Mitra interstriata Sowerby (Thes. Conch. fig. 392) resembles this species somewhat in color, but it is wider, contracted more above the more prominent siphonal fasciole, and has a wider aperture.

Vexillum xenium n. sp. Pl. XII, fig. 25.

The shell is fusiform, white with a chestnut band traversed by several paler spiral lines, below the periphery, two or three paler interrupted lines above it on the summits of the ribs only, and a few widely spaced blackish-brown spots below the suture, on the ends of some of the ribs. The first three whorls are also deep brown. Sculpture of smooth, longitudinal ribs, 22 on the last whorl, equal to their interstices, the latter marked with short impressions in spiral series, 6 on the penult whorl in each interval; base spirally grooved over ribs and intervals forming about 4 spiral series of tubercles. Two obliquely spiral cords are more prominent just above the siphonal fasciole. Aperture shorter than the spire, the throat with 9 thin beaded lirae. Columella with 5 thin plaits.

Length 18, diameter 7.5, aperture 8.4 mm., 10 whorls.

Off Waikiki, Oahu, 25-50 fms. D. B. Langford.

Turricula approxima Pease (P. Z. S. 1860, p. 146) is described as convexly angulated at the sutures and with 4 plaits; it seems therefore to be a different species.

Vexillum micra n. sp.

The shell is fusiform, vinaceous tawny with a band at the periphery and another on the base of burnt umber. Sculpture of many vertical rounded ribs, about 30 on the last whorl, the intervals with wide, low spiral cords separated by impressed lines, of which there are 4 on the penult whorl; base with spiral cords. Aperture colored like the outside. Columella with four plaits. The embryonic shell is long-conic, of about $3\frac{1}{2}$ smooth whorls.

Length 6.5, diameter 2.7, aperture 3 mm.; $5\frac{1}{2}$ post-embryonic whorls.

Off Waikiki, Oahu, in 25-50 fms. D. B. Langford.

One specimen is a little stouter and lacks the lower brown band.

Vexillum turben kanaka n. subsp. Pl. XII, fig. 26.

The shell is similar to *M. turben* Reeve (Philippine Islands) in sculpture and the ochraceous-buff or buff-yellow color, but the spire is more shortly and a little concavely conic above, the penult whorl slightly swollen. There are six plaits, the upper one strong and horizontal. Within the outer lip there is a small fold, more prominent than the others about the upper third.

Length 22.7, diameter 12 mm.

Length, 21, diameter 10 mm.

Honolulu, on the dredge dump, J. M. Ostergaard.

Three specimens of this exquisite shell have been taken. On comparison with a specimen of Reeve's species they show certain differences of shape which seem to be of racial significance.

The related *M. baldwini* Melvill is very different in color and sculpture. It should be compared with *T. flammulata* Pease, which may be the same.

XII. VARIOUS OTHER GASTROPODS

Murex pele Pilsby. Pl. XI, figs. 29, 30.

Murex pele Pils., Nautilus XXXI, pl. 3, figs. 9, 12.

Off Waikiki, Oahu, in 35-50 fathoms. D. B. Kuhns, 1916. Type no. 47191 A. N. S. P. Also in the Thaanum collection.

Closely related to *M. rota*, which it resembles in general form. Pure white. The nuclear whorls are lost. The first $2\frac{1}{2}$ remaining whorls form a slender, slowly tapering style, the whorls being nearly flat, the suture oblique, well impressed, bridged by a few laminae. After that the shell enlarges abruptly; the next $1\frac{1}{2}$ whorls being carinate, flattened above the keel, very deeply excavated below it, crossed by six lamellar founced varices on a whorl. The last whorl is rounded with several quite low spiral welts. The six varices, which increase progressively and rapidly in prominence, are connected by broad lamellae with the preceding whorl, dividing the sutural region into a series of deep cavities. The varices bear long spines, blunt or expanded at the ends, crenulated on the back and sides, slit in front. There are two of these processes on each varix much larger than the others, more expanded at the ends. A series of little

foliations stands at the front bases of the large processes. The aperture is small, oval. The long anterior canal is nearly or quite closed.

Length 31, diameter, including spines 18.5 mm. Type, fig. 29.

Length 40, diameter, including spines, 30 mm.

The operculum is Purpuroid, the nucleus lateral. It has external sculpture of concentric laminae, which are prominent and crimped in the outer and basal parts, subobsolete in the median and inner portions, which are nearly smooth, or merely wrinkled.

Compared with *M. rota* Sowb., this species differs by having fewer enlarged spines. *M. rota* has four or five subequal ones on the last varix, of which at least three radiate from the aperture like the spokes of a wheel, and one is on the canal. In *M. pele* there are only two enlarged processes. Other characters of the two species appear to be much alike, though in the old specimens of *M. rota*, which alone are at hand for comparison, the whorls of the spire are worn, and the earlier ones lost. It attains a greater size than the Hawaiian species.

The largest individual of *M. pele* found (Pl. XII fig. 30) is evidently quite old. It is much encrusted. The quite clean one selected for description (fig. 29) is probably nearly a whorl short of full size.

***Murex torrefactus insularum* n. subsp.**

Specimens from off Waikiki, Oahu, in 35-50 fms. (Langford), differ from the typical form of *M. torrefactus* Sowb., being relatively larger, with somewhat less complex variceal processes, the second from above nearly as long as the first and receding. *M. rubiginosus* Reeve has a larger aperture, and the second variceal process does not recede.

Length 69, diameter 44 mm.

***Sistrum vitiense* n. sp.**

Viti Islands, A. J. Garrett. Type and paratypes no. 36732 A. N. S. P.

The shell is stout, ovately fusiform, solid, with straightly conic spire. The ground color is buff-yellow. It is rather weakly plicate longitudinally, with about seven low spiral cords, which are enlarged to form oblong tubercles, from hazel to chestnut-brown in color where they pass over the folds. The tubercles of the series below the suture are lower than the others and separated from the next series by a wider space. Between the tuberculose girdles there

are two or three low cords in each space, all being slightly irregular. The rather prominent siphonal fasciole is apricot-orange colored.

The aperture is white; outer lip having a series of five or six teeth within, the upper and lower ones slightly larger. The columella is straight, having several short, rather strong transverse folds below the middle.

Length 22.5, diameter 14 mm.

It is related to *S. concatenatum* (Lam.), but it is a more compact shell with smaller white aperture, and much less coarse sculpture.

Cymatium species.

Cymatium intermedium (Pease) is the most abundant Triton in Oahu. *C. chlorostoma* (Lam.) is found in Honolulu Harbor, Hilo and other places. *C. tuberosum* Lam. is not uncommon on reefs.

C. vestitum Hinds⁹ is represented by a race in which the tooth intervals are carnelian red or rufous, the form more slender, and the few intervarticeal ribs are very weak. Length 74, diameter 34mm. This race may be called *C. vestitum insulare*. Type no. 35279 A. N. S. P.

The finest specimen I have seen is in the collection of Irwin Spalding.

Strombus ostergaardi n. sp. Pl. XII, figs. 27, 28.

The shell is somewhat pear-shaped, rather solid, white in the only examples known, which are long-dead shells.

The rather short spire is concavely conic. In the most perfect example the penult whorl is weakly angular above the suture, with very weak, coarse nodes; the next earlier whorl is distinctly angular and tuberculate; above this the tubercles become closer, longer, so that the next two whorls are costate. The conic summit, of about 3 convex whorls, is smooth. The last whorl is very slightly compressed between face and back. It is slightly swollen behind the outer lip, somewhat flattened preceding the swelling, on the ventral face strongly convex above. It is smooth except for oblique grooves around the lower part and more or less distinct spiral threads near the lip. The suture descends in the last third of a whorl, ascending a little at its termination. The aperture is narrow. Outer lip not excavated posteriorly, having a moderate sinus anteriorly; closely lirate within. The inner lip is thick, with well defined edge, and is regularly lirate throughout.

⁹Zoology of the Voyage of the Sulphur, II, 1844, p. 11, pl. 4, figs. 1, 2.

Length 24.5, diameter 12 mm.

Length 31, diameter 16 mm.

Honolulu Harbor, from the dredger dump on the Harbor side of Sand Island, J. M. Ostergaard. Also from the Kailua coast, on the north side of Oahu, W. A. Bryan.

This species is less distorted than *S. gibberulus* L., with a lirate columellar callus, and no excavation of the outer lip posteriorly. *S. bulbulus* Sowb. is more closely related, but it has a smooth, thinner and less extended columellar callus, and smooth, convex whorls of the spire.

While the specimens have the appearance of fossils, it is likely that the species is still to be found living. The single one before me from Kailua is 21.3 mm. long, and has the short spiral threads over the swelling behind the lip more distinct.

In the largest specimen there seems to be but one nodulose intermediate whorl of the spire, the whorls having the usual impressed spiral line below the suture; but as the spire is quite short, the nodules may be concealed by the enveloping whorls. The sculpture of the spire described above is therefore not a constant feature.

This stromb was first found by Mr. Ostergaard in 1905. Subsequently he found three more.

***Rissoina striatula hawaiiensis* n. subsp.**

Differ from *R. striatula* Pease¹⁰ by the constantly smaller size.

Length 4.5 mm.

Length 5.2, diameter .2 mm.; 9 whorls (type).

Length 6.4, diameter 2.7 mm.

Oahu: Paumalu, type loc.; Waimea. Kauai: Haena. All collected by W. A. and E. J. Bryan.

R. striatula was described from the Paumotu group. Two specimens measure:

Length 8.3, diameter 3.5 mm.

Length 8.6, diameter 3.4 mm. (Cotype, figured in A. J. C.)

XIII. PELECYPODS.

***Modiolus matris* n. sp. Pl. XII, fig. 18.**

The shell is small oblong wedge-shaped, strongly inflated, thin, bright colored, the prevalent colors being old rose, apricot buff, pueric yellow, or white with vinaceous rays; having a thin yellowish

¹⁰Amer. Journ. Conch. III, 1867, p. 296, pl. 24, fig. 31.

cuticle, in large part deciduous, chiefly preserved near the posterior end, and bearing very delicate raised concentric striae. Beaks are rather prominent. The hinge-line is short, slightly curved under the beaks. Internal margins smooth. The interior is colored like the outside but usually brighter in tone.

Greatest length 12.5, greatest breadth 6.5, diameter 6.5 mm.

Greatest length 12.8, greatest breadth 8, diameter 7 mm.

There is considerable variation in contour. The largest valve seen, from Moomumi, Molokai, measures, length 19.3, width 10.2, semidiameter 4.8 mm.

Oahu; Rabbit Island; Paumalu; Mokapuu Point (type loc.), Honolulu Harbor. Molokai: Moomomi. Pukahaku. Midway Island. Pearl and Hermes Reef (W. A. and E. J. Bryan).

Modiolus peasei Newcomb.

1870. Amer. Journ. Conch. V, p. 163, pl. 17, fig. 7. ("Sandwich Islands, dredged in 12 fms., outer harbor of Honolulu").

Off Honolulu in 6 fathoms, D. B. Langford, 1915; Off Mala Bay, West Maui, 21 fathoms, Thaanum and Langford, 1918. From the second locality there are very fine specimens, up to 31 mm. long.

Mytilus crebristriatus Conrad.

1837. Conrad, Journ. Acad. Nat. Sci. Phila. VII, p. 242.

1916. Bryan, Nat. Hist. of Hawaii, p. 457, pl. 104, fig. 1.

Oahu: Honolulu Harbor; Pearl Harbor. Molokai: Kainalu. Hawaii: Hilo.

The large typical form of this species is particularly abundant in Pearl Harbor and the adjacent fossil deposits. In Honolulu it occurs on the Kewalo reef, off the mud flats where considerable fresh water comes in, and *Melania muiensis* is abundant. Probably typical *M. crebristriatus* occurs only where the salt water is slightly diluted with fresh; on open shores it is replaced by a small form.

The usual length of *M. crebristriatus* is from 25 to 35 mm. So far as we know, the only published figure is that in Bryan's Natural History of Hawaii.

A very thick form was found fossil at Waimanalo, Oahu, by Prof. Bryan.

On most of the open beaches a small form, which may be called form *maritima*, is found in abundance; the length is 10 to 15 mm. Localities for this form follow, mainly from the Bryan collection.

Ocean Island. Mokumanu. Kauai: Hanalei, Haena, Milolii, Kalalau. Oahu: Honolulu Harbor, Mokapu Point, Kailua, Paumalu, Waimanalo, Kaneohe Bay, Laie. Molokai: Moomomi, Kainalu, Papohaku. Maui: Maalaea Bay, Kahului. Hawaii: Hilo.

At Kainalu, Molokai, a set was taken having the shell very thin and frail, the corrugation weakly developed. Length 17 mm.

Congeris bryanæ n. sp.

The shell is triangular, very much inflated along the middle of its length, the ventral side flattened and subtruncate, the posterior and dorsal borders, beyond the hinge, broadly rounded. Sculpture of very numerous radial riblets crossed by closer and narrower concentric threads which are more prominent in the intervals. The color is green or yellow, uniform or clouded in varying shades and tints, often with some irregular, maculation of brown, or whitish and pale yellow with vinaceous or pink maculation. The interior is whitish, more or less tinted with the external colors. The septum is small. There are about 10 rather strong teeth in each valve, between beaks and septum, and a group of elongated crenulations at the posterior end of the hinge-line. The rest of the internal margin is delicately crenulate.

Length 6.5, width 4.3, diameter 5 mm.

Length 11.2, width 6.6, diameter 6 mm.

Oahu: Mokapu Point, Kailua, Paumalu, Rabbit Island (type loc.), Makapuu Point, Honolulu Harbor. Kauai: Mouth of Hanalei River. Molokai: Moomomi. Laysan Island. Pearl and Hermes Reef (W. A. and E. J. Bryan).

Mytilus bifurcatus Conrad, said to be from the Sandwich Islands, is a common Californian species. See Nautilus XII, Oct., 1898, p. 69.

Cardium thaazumi n. sp. Pl. XII, fig. 24.

The shell is small, plump, thin. Beaks full, slightly inclined forward, nearly smooth; posterior end truncate, anterior rounded. White with the beaks and numerous rays of a light coral red color; the rays faint except towards the periphery.

Sculpture of many very fine, even radial striae, which are closely, minutely prickly towards the periphery and ends. Hinge-teeth well developed; inner margin crenulated.

Length 11, height 10.5, diameter 9 mm.

Off Waikiki, Oahu, 35 to 50 fathoms. Also off Launiupoko Camp, near Lahaina, West Maui 4 to 8 fathoms, Thaazumi and Langford.

Two other species of *Cardium* are not uncommon, the large *Cardium orbita* B. and S., Hilo, Hawaii (Thaanum); Moomomi, Molo kai, Haena, Kauai (Bryan), and *C. arcuatulum* Sowerby, a very small, angular *Fragum*, from Hilo, Hawaii (Thaanum); Honolulu (Bryan), and Haleiwa (Pilsbry), Oahu.

***Solecardia bryani* n. sp. Fig. 5.**

The shell is thin, oval, somewhat inequilateral, moderately plump, white. Upper and lower margins subequally curved; anterior end narrower than the posterior, both being rounded. Except the beaks, the surface is minutely densely punctate, more coarsely so near the ends; the points arranged in radial lines on the dorsal posterior slope, elsewhere irregularly or in indistinct zigzags. Right valve having a slender, erect, cardinal and a low, elongate posterior tooth.

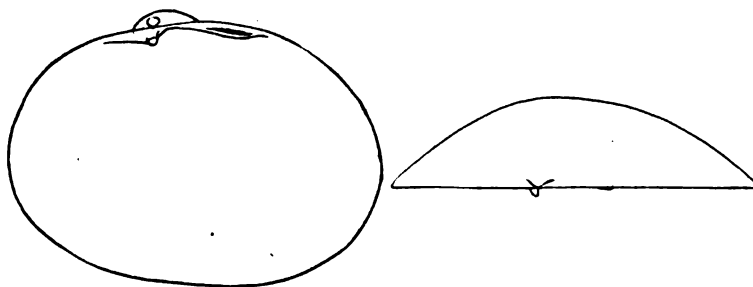


Fig. 5.—*Solecardia bryani*, n. sp., interior and dorsal view of right valve.

Length 10.8, altitude, 7.8, diameter 5.2 mm.

Oahu: Paumalu, W. A. and E. L. Bryan.

***Solecardia hawaiiensis* n. sp. Fig. 6, a, b, c.**

The shell is thin, white, oblong, moderately plump, inequilateral. Dorsal margin arched, a little more curved than the basal; anterior end vertically subtruncate, anterior end rounded. Beaks very small with more convex, orbicular embryonic caps. Surface glossy, with fine growth lines only. Interior dull, the muscle impressions and pallial line rather indistinct. Right valve with a strong, erect anterior tooth and an elongate, lower posterior. Left valve has strong median, weak anterior and elongate posterior tooth.

Length 7, altitude 4.8, diameter 3.4 mm.

Hawaii: Hilo, Thaanum, type loc. Kahoolawe, on the north shore (Pilsbry). Molokai: Kainalu and Moomomi (Bryan). Oahu: Honolulu Harbor and Paumalu (Bryan), near Kahuku and Haleiwa

(Pilsbry). Kauai: Hanalei river (Bryan). Laysan Island (Capt. Brown).

Near the figure of *Scintilla deshayesi* Sowb., but more elongate, not so abrupt posteriorly. *Erycina ovata* Gld.¹¹ is less inequilateral, and the anterior truncation is a little oblique. The teeth, too, appear to differ, if Gould's figure is correct.

***Solecardia hawaiiensis obesior* n. sub.p. Fig. 6, d, e.**

Similar to *S. hawaiiensis*, but plumper, shorter, with wider beaks.

Length 7, altitude 5.3, diameter 4.7 mm.

Honolulu Harbor (W. A. and E. L. Bryan).

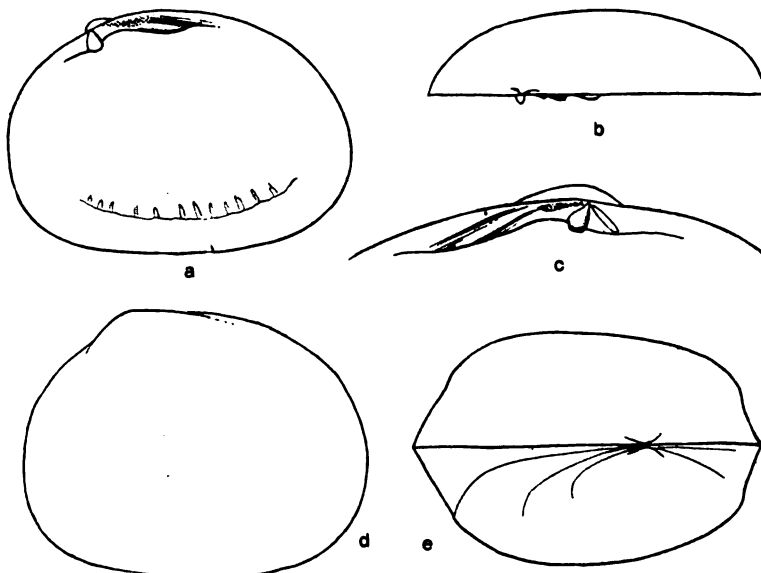


Fig. 6.—a, b, *Solecardia hawaiiensis*, interior and dorsal views of right valve; c, hinge of left valve. d, e, *Solecardia hawaiiensis obesior*, lateral and dorsal views.

***Solecardia stigmatica* n. sp. Fig. 7**

The shell is very thin, fragile, somewhat ovate, the anterior end narrower, posterior end broadly rounded, rather compressed, white, with a median radial russet band, fading at the edges and below. Surface glossy, marked with faint growth lines. Interior dull. Right valve having a slender, erect cardinal tooth. Left valve with an elongate, lower one.

¹¹U. S. Expl. Exped. Mollusca, p. 401, pl. 44, figs. 387–387b. Sandwich Islands.

Length 5.3, altitude 3.5, diameter 1.8 mm.

Hilo, Hawaii, D. Thaanum.

Easily known by the rich brown stripe.

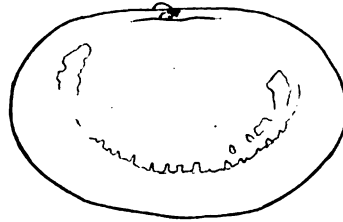
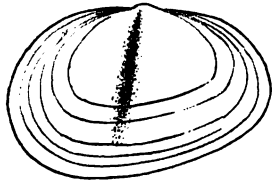


Fig. 7.—*Solecardia stigmatica* n. sp.

Fig. 8.—*Solecardia thaanumi*, n. sp.

Solecardia (Scintilla) thaanumi n. sp. Fig. 8.

The shell is white, oblong, the basal margin slightly more curved than the upper, not gaping; ends rounded, the anterior slightly shorter; compressed, slightly inequilateral. Beaks very small, capped with minute, orbicular embryonic valves. Surface with faint growth lines. Interior dull, minutely vermiculate with white on a grayish ground outside of the pallial line, which is distinct and irregular. Cardinal tooth of right valve very low, indistinct.

Length 6.75, altitude 4.25, diameter 2.4 mm.

Hawaii: Hilo, D. Thaanum.

Solecardia (Scintilla) chascax n. sp. Fig. 9.

The shell is very thin, fragile, compressed, oblong, subequilateral, broadly gaping below; whitish, translucent. Hinge margin straight;



Fig. 9.—*Solecardia chascax*, interior and ventral views.

basal margin straightened in the middle, then somewhat dilated anteriorly; ends rounded. Beaks very small. Both valves have a very low, indistinct cardinal nodule but no other teeth.

Length 6.9, altitude 3.8, diameter 2 mm.

Hawaii: Hilo, D. Thaanum.

Thecodonta (?) *symmetrica* n. sp. Fig. 10.

The shell is oval, white, very inequilateral, the beaks being nearly terminal, moderately convex, basal margin more curved than the dorsal. Exterior smooth except for very faint growth lines. In the right valve there is a bilobed tooth in front of the beaks, low, elongate lamina posteriorly.

Length 2.65, altitude 1.9, diameter 1.1 mm.

Oahu: Haleiwa on the beach, Pilsbry, 1913.

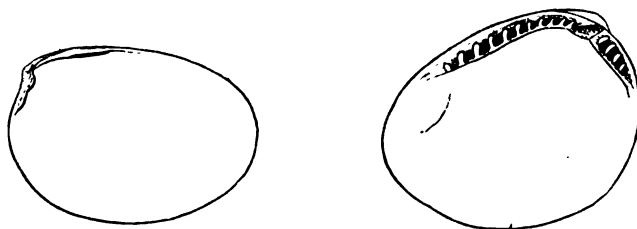


Fig. 10.—*Thecodonta* (?) *symmetrica*. Fig. 11.—*Nucula hawaiiensis* n. sp.

Nucula hawaiiensis n. sp. Fig. 11.

The shell is white, broadly ovate, moderately plump, smooth near the beaks, elsewhere very closely ridged with smooth, regular concentric striae. Anterior end broadly rounded, posterior narrowly rounded; basal margin more arcuate than the dorsal. The teeth are rather short, 5 before and 10 behind.

Length 2.8, altitude 2.2, diameter 1.5 mm.

Oahu: Haleiwa, on the beach, Pilsbry, 1913.

Probably immature.

EXPLANATION OF PLATE XII.

- Fig. 1.—*Terebra thaanumi* n. sp. Type 117019.
- Fig. 2.—*Terebra thaanumi* Waikiki. 74526.
- Fig. 3.—*Terebra flavofasciata* n. sp. Type. 46909.
- Fig. 4.—*Terebra argus brachygyra* n. subsp. Type. 46910.
- Fig. 5.—*Terebra langfordi* n. sp. Type. 117038.
- Fig. 6.—*Terebra langfordi angustior* n. subsp. Type.
- Fig. 7.—*Terebra lanceata oahuensis* n. subsp. 117041.
- Fig. 8–10.—*Terebra medipacifica* n. sp. Type and paratype. 117039.
- Fig. 11.—*Terebra medipacifica melior* n. subsp. Type.
- Fig. 12.—*Terebra waikikiensis* n. sp. Type. 117030.
- Fig. 13.—*Terebra spaldingi* n. sp. Type. 117044.
- Fig. 14.—*Mitra ticaonica vagans* n. subsp. Honolulu Harbor.
- Fig. 15.—*Mitra ticaonica vagans* n. subsp. Type. Hilo. 46790.
- Fig. 16.—*Mitra lugubris honoluluensis* n. subsp. Type. 46793.
- Fig. 17.—*Mitra waikikiensis* n. sp. Type. 46788.
- Fig. 18.—*Modiolus matris* n. sp. Type. 47193.
- Fig. 19.—*Mitra emersoni* n. sp. Type. 46804.
- Fig. 20.—*Mitra langfordi* n. sp. Type. 46805.
- Fig. 21.—*Mitra thaanumiana* n. sp. Type. 46810.

- Fig. 22.—*Mitra ostergaardi* n. sp. Type. 46770.
Fig. 23.—*Mitra kamehameha* n. sp. Type. 46793.
Fig. 24.—*Cardium thaanumi* n. sp. Type. 47179.
Fig. 25.—*Vexillum xenium* n. sp. Type. 116983.
Fig. 26.—*Vexillum turben kanaka* m. subsp. Type. 46763.
Figs. 27, 28.—*Strombus ostergaardi* n. sp. Type and paratype. 74549.
Figs. 29, 30.—*Murex pele* Pils. Type and paratype.
Fig. 31.—*Vexillum thaanumi* n. sp. 46820.

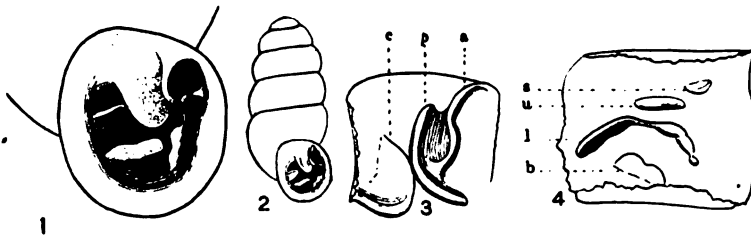
A COLOMBIAN PUPILLID SNAIL.

BY HENRY A. PILSBRY.

Among other interesting mollusks collected by Messrs. Morgan Hebard and J. A. G. Rehn during their recent visit to Colombia, there were specimens of a peculiar snail of the family Pupillidæ, which may be described as follows.

Gastrocopta colombiana n. sp. Figs. 1-4.

The shell is thin, faintly brown tinted, subcylindric, but tapering very slowly from the last whorl, composed of $5\frac{1}{2}$ strongly convex whorls, the last whorl somewhat flattened dorsally, with a slight impression over the inner part of the lower palatal fold. Faintly striate. The aperture is squarish-oval; peristome thin, well expanded and reflected, continuous across the parietal wall, but very shortly adnate there. The angulo-parietal lamella reversed y-



Figs. 1, 2.—*Gastrocopta colombiana*, enlarged aperture and front view of type.

Fig. 3.—Columella and parietal wall seen from below, the peristome above, showing: *c*, columellar lamella; *p*, parietal, and *a*, angular lamellae.

Fig. 4.—Inside of the palatal wall, the peristome on the right. *s*, suprapalatal fold; *u*, upper palatal; *l*, lower palatal, and *b*, basal folds.

shaped, the angular sinuous, emerging to the lip edge, parietal arcuate, higher, emerging much less. Columellar lamella strong, lunate, the inner half descending, outer horizontal. Within the outer lip there is a small, high, suprapalatal fold and a larger, more immersed upper palatal. Lower palatal fold is very long, somewhat immersed, oblique and indistinctly binodose in front, its upper end continued inward as a slender ridge, then enlarging into a high, stout fold. The basal fold is transverse, weakly bilobed.

Length 2, diameter 0.9 mm.

Puerto Columbia, dept. Atlantico, Colombia, on limestone hills. Morgan Hebard and J. A. G. Rehn, 1920. Type and paratypes no. 46634 A. N. S. P.

While this species of the subgenus *Immersidens* is somewhat similar to *G. cochisensis*, *G. dalliana* and other North American snails of the same subgenus, it differs remarkably in the palatal folds, the upper being doubled, probably by division of a primitively single upper palatal, and the lower fold enters so deeply that its full structure can be understood only by breaking out the palatal wall, as in fig. 4.

A weak-toothed form of *Gastrocopta servilis* (Gld.) referable to *G. s. riisei* (Pfr.), was found in the same locality.

STATISTICAL OBSERVATIONS ON THE TEXAS FEVER PARASITE.

BY HOWARD CRAWLEY.

The study herein described was based on material obtained from two cows, Nos. 1025 and 1031, of the series of the Experiment Station of the United States Bureau of Animal Industry. These, being so-called northern animals, were susceptible to Texas fever, and were both inoculated with this disease by infestation with infectious seed ticks on June 27, 1913. Cow No. 1031 died on July 10, and a series of preparations was obtained shortly after death from the heart muscle, the liver, the spleen, and the kidney. Cow No. 1025 died July 11, and a set of smears was obtained from the heart muscle.

The morphology of the Texas fever parasite, for which the correct name appears to be *Babesia bovis*, has been described a number of times and is in consequence a matter of common knowledge. This phase of the biology of the organism was therefore not studied, but since the material obtained, especially from Cow 1031, was rich in parasites and parasitized cells, a statistical investigation was undertaken. This had to do, first, with the relative numbers of parasitized and non-parasitized cells; second, with the number of individual parasites in each parasitized cell; third, with the varying conditions found in the several organs of Cow 1031; finally, a count was made of the parasites occurring free in the preparations. The exact significance of these latter is somewhat problematical, since, theoretically, they may either represent elements escaped from a blood cell, or merely what remains after the blood cell has been destroyed. The latter supposition seems the more probable, since these parasites, like those within the cells, may occur either singly or in multiple form. Indeed, the fact that these apparent free parasites occur in multiple form rather suggests that they are still lying in some remnant of the blood cell which does not stain. The impression received from an examination of this material is that these "free" parasites have no especial significance, and are to be placed in the same category as those still lying in intact blood cells.

The smears were fixed in alcohol and stained with Giemsa. The method of study was very simple. A small square was cut on a

round cover glass with a diamond, and placed in the eye-piece of the microscope. The square marked out a small region in the smear and all the cells in this region were then taken into account. These regions were selected wholly at random, in fact, without being first seen. The only restriction was that those cases where the blood cells were very closely crowded were not used.

Taking up first the ratio of parasitized and non-parasitized cells, the counts made gave the following results:

TABLE 1.

Cow 1031	Parasitized cells	Non-parasitized cells	Total
Heart.....	4563	4083	8646
Kidney.....	767	464	1231
Spleen.....	348	2495	2843
Liver.....	1048	1646	2694
Totals	6726	8688	15414
Cow 1025			
Heart.....	250	3732	3982

Reducing the above to percentages we obtain:

TABLE 2.

Cow 1031	Parasitized	Non-parasitized
Heart.....	52.8 per cent.	47.2 per cent.
Kidney.....	62.3	37.7
Liver.....	38.9	61.1
Spleen.....	12.2	87.7
Totals	43.64	56.36
Cow 1025		
Heart.....	6.30	93.70

The first distinction to be noted is that between the two cows. In 1031, at least as regards the heart, the split is about even, there being practically as many parasitized as non-parasitized cells. On the other hand, in Cow 1025, the ratio is roughly 1 to 15. This cow survived for one day longer than did 1031, and this may be the explanation, but a much more precise study than was made would be necessary to elucidate this problem.

Turning our attention to Cow 1031, it is easily seen that there is a marked distinction between the conditions in the different organs. The heart, kidney, and liver may be grouped, although the differences between them are too great to be accredited to a mere accidental variation. It may also be noted that the liver shows a lower ratio of parasitized cells than does either the heart or kidney. This is in contrast to what occurs in infections with trypanosomes, these

parasites tending to persist in the liver after they have disappeared from other organs. At least this is stated to be the condition found post mortem.

But the very low percentage of parasitized cells present in the spleen, only 12.2 per cent, as against the general percentage of 43.64 in this cow is very clearly significant. It is usual to ascribe to the spleen a hemolytic function, and we appear to have an example of it here. The assumption is that the cells would themselves be destroyed, and along with them their contained parasites. In the case in point, however, it is necessary to assume that the parasitized cells are destroyed more easily than those which are still intact, but this is something which would be anticipated. The presence of the piroplasm in the cell would in all probability render it more susceptible to any destructive influence.

In the parasitized cells, the number of parasites per cell ranges from one to six, the following table showing the count:

TABLE 3.

	PARASITES PER CELL						Total.
	1.	2.	3.	4.	5.	6.	
Cow 1031							
Heart.....	3537	5354	247	151	4	1	9294
Kidney.....	1237	305	20	5	0	0	1567
Liver.....	2372	315	10	4	0	0	2701
Spleen.....	1301	85	2	1	0	0	1389
Cow 1025							
Heart.....	1317	1394	29	22	0	0	2762
Totals	9764	7458	308	183	4	1	17713

Reducing the above to percentages, we obtain:

TABLE 4.

	1.	2.	3.	4.	5.	6.
Cow 1031						
Heart.....	38.06	57.61	2.66	1.62	.04	.01
Kidney.....	78.94	19.46	1.28	.32	0	0
Liver.....	87.82	11.66	.37	.15	0	0
Spleen.....	93.67	6.12	.14	.07	0	0
Cow 1025						
Heart.....	47.68	50.47	1.05	.80	0	0
Totals	55.12	42.08	1.74	1.03	.02	.01

It is perhaps desirable to mention what at first glance looks like a discrepancy in the data. For example, in Table 3 there are given 2762 parasitized cells from the heart of Cow 1025, whereas in Table 1 this cow is credited with only 250 parasitized cells. This merely means that in the two cases the results were based on different counts. Thus, in the data given in Table 1 the cells were merely

separated into those that were parasitized and those that were not. It was found much easier to handle the material in this manner and the data given in Table 3 were based on a wholly separate set of observations from those given in Table 1. It is, however, believed that in obtaining the results set forth in Tables 1 and 2, the number of cells counted is large enough.

Turning our attention now to Tables 3 and 4, the percentages obtained from the slides taken from the hearts of Cows 1025 and 1031, respectively, are probably not far enough apart to warrant any conclusions, but a sharp distinction is to be seen between the findings in the different organs of Cow 1031. Thus, whereas, in the heart there were only some 38 per cent of the single parasites, this percentage rises to nearly 94 in the case of the spleen. It has already been suggested that the low percentage of parasitized cells in the spleen may be explained by supposing that the parasitized cell is more easily destroyed than that not parasitized. If this be so it would be consistent to suppose that as the number of parasites present increases, the invaded cell becomes more and more readily destroyed. For, since the parasite must enter the cell as a single organism, the multiplicative stages are indicative of a more prolonged occupancy, which in its turn is correlated with a greater damage to the cell. Moreover, two or more parasites occupy a greater volume than one, and this also would render the cell more liable to destruction. It is in support of this explanation that the liver stands next to the spleen both in regard to the proportion of parasitized cells and in the proportion of those which contain but a single parasite. These figures at least suggest that the liver is not a favorable environment for *Babesia*.

In addition to the above, a number of the so-called "free" parasites were counted, the results being given in Tables 5 and 6. This could not be done with the spleen, which may be due either to the fact that the smears from this organ are never so clean as those from other situations, or to the fact that, as suggested, the parasites are here more quickly destroyed. The tables follow:

TABLE 5.

	1.	2.	3.	4.	5.	6.	Total
Cow 1031							
Heart.....	623	1057	38	39	0	0	1757
Kidney.....	1044	223	4	4	0	0	1275
Liver.....	262	28	0	0	0	0	290
Cow 1025							
	304	512	12	20	2	1	851
Totals	2233	1820	54	63	2	1	4173

Changing these figures to percentages we obtain:

TABLE 6.

Cow 1031						
Heart.....	35.46	60.16	2.16	2.22	0	0
Kidney.....	81.89	17.49	.31	.31	0	0
Liver.....	90.34	9.66	0	0	0	0
Cow 1025						
Heart.....	35.73	60.17	1.41	2.35	.23	.11
Totals	53.51	43.61	1.29	1.51	.05	.03

If Table 6 be compared with Table 4 it will be observed that there is a quite close accord so far as Cow 1031 is concerned. With regard to Cow 1025, however, there is a noticeable smaller percentage of the single forms. It is also to be noted that whereas in Table 3 there are a good many more parasites in the three stage than in the four, that this is reversed in Table 5.

Finally, as regards the number of parasites in each group, Tables 7 and 8 combine both those present in the cells and those which were apparently free.

TABLE 7.

Cow 1031	1.	2.	3.	4.	5.	6.	Total
Heart.....	4160	6411	285	190	4	1	11051
Kidney.....	2281	528	24	9	0	0	2842
Liver.....	2634	343	10	4	0	0	2991
Spleen.....	1301	85	2	1	0	0	1389
Cow 1025							
Heart.....	1621	1906	41	42	2	1	3613
Totals	11997	9273	362	246	6	2	21886

Reducing to the usual percentages we get:

TABLE 8.

Cow 1031	1.	2.	3.	4.	5.	6.
Heart.....	37.64	58.01	2.58	1.72	.04	.01
Kidney.....	80.26	18.58	.84	.32	.0	0
Liver.....	88.07	11.47	.33	.13	0	0
Spleen.....	93.67	6.12	.14	.07	0	0
Cow 1025						
Heart.....	44.87	52.75	1.13	1.16	.06	.03
Totals.....	54.82	42.37	1.65	1.12	.03	.01

The percentages of Table 8 run very close to those of both Tables 4 and 6, which was of course to be expected. It may be of interest to note that of nearly twenty-two thousand cases there were only six groups of five and two groups of six.

With regard to the shape of the paired parasites, they were either approximately round or approximately piriform. Of 741 cases noted, in 406 the parasites were round, in 335 piriform. It may be mentioned, however, that the parasites found in smears of the organs made post-mortem are always smaller and rounder than those in smears made from the peripheral blood of the living cow. To the best of my knowledge, the only author who has emphasized this fact is Theobald Smith.

**AMERICAN DERMAPTERA OF THE MUSEUM NATIONAL D'HISTOIRE
NATURELLE, PARIS, FRANCE.**

BY MORGAN HEBARD.

The series here treated was recently forwarded for determination by Monsieur Lucien Berland, of the Paris Museum. Though including but one hundred and seven specimens, the collection has been found to have represented in it a number of little-known as well as undescribed forms, well worth reporting as a contribution to the knowledge of the American Dermaptera.

The series has been returned to the Paris Museum, with the exception of a few duplicates now in the collection of the author, deposited at The Academy of Natural Sciences of Philadelphia.

Thirty-six species are represented. Of the new species described, one is from Guatemala, three from French Guiana and one from Argentina.

PYGIDICRANIDAE.

PYGIDICRANINAE.

***Pygidicrana bivittata* Erichson.**

1848. *Pygidicrana bivittata* Erichson in Schomburgk, Reisen in Brit. Guiana, III, p. 579. [British Guiana.]

St. Jean du Maroni, French Guiana, IV to V, 1914, 1 juv.

The present determination is made with some uncertainty, as the immature example before us (length, exclusive of forceps, 11.3 mm.) has the pronotum heavily suffused with blackish, being pale only in a medio-longitudinal line and along the lateral and caudal margins. The difference from the original description may be due to individual intensification of color pattern, or an undescribed species may be represented.

The head, mesonotum, metanotum and abdomen are black, except the four proximal abdominal tergites, which are buffy in a broad median section. The limbs are buffy, with the femora suffused with black ventrad on their cephalic faces. The forceps are long (3.7 mm.), straight and slender, subadjacent to their sharply incurved and acute apices, with internal margin microscopically serrulate.

PYRAGRINAE.

***Pyragra fuscata* Serville.**

1831. *Pyragra fuscata* Serville, Ann. Sci. Nat., XXII, p. 34. [French Guiana.]

St. Jean du Maroni, French Guiana, 1 ♀, 1 juv. St. Laurent du Maroni, French Guiana, 1 ♀. Nouveau Chantier, French Guiana, 1 juv.

***Pyragra brasiliensis* (Gray).**

1832. *Forficula brasiliensis* Gray in Griffith, Anim. Kingd., XV, p. 184, pl. 78, fig. 2. [Brazil.]

Curityba, Parana, Brazil, 1 ♂. San Ignacio, Misiones, Argentina, 1 ♀.

***Pyragropsis paraguayensis* (Borelli).**

1904. *Pyragra paraguayensis* Borelli, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XIX, No. 479, p. 1. [♂, ♀; Asuncion, Luque and Villa Rica, Paraguay; Caiza and Mission of Aguairenda, Bolivia; Corumbá, Brazil.]

Villa Lutecia, San Ignacio, Misiones, Argentina, I to IV, 1910, 1 ♀, 1 juv.

LABIDURIDAE.

ESPHALMENINAE.

***Esphalmenus lativentris* (Philippi).**

1863. *Forficula lativentris* Philippi, Zeitschr. gesam. Naturwiss., XXI, p. 217. [♂, ♀; Province of Valdivia, Chile.]

Province of Aconcagua, Chile, (José N. Thomas), 2 ♀.

PSALINAE.

***Psalis americana* (Beauvois).**

1817. *Forficula americana* Beauvois, Ins. rec. Afr. Amér., p. 165, Orth., pl. XIV, fig. 1. [San Domingo.]

Port-au-Prince, Haiti, 3 ♂, 3 ♀. Havana, Cuba, 1 ♀.

***Euborellia janeirensis* (Dohrn).**

1864. *F[orcinella] janeirensis* Dohrn, Stett. Ent. Zeit., XXV, p. 285. [Rio de Janeiro, Brazil.]

Bahia, Brazil, 1 juv.¹

***Euborellia minuta* (Caudell).**

1907. *Anisolabis minuta* Caudell, Jour. N. Y. Ent. Soc., XV, p. 168. [♂, ♀; Arroyo and Mayaguez, Porto Rico.]

Havana, Cuba, 1 ♂, 1 ♀.

¹ Three females recorded by Rehn as *Anisolabis annulipes* (H. Lucas) from Independencia, Parahyba, Brazil, are found to represent individuals of the present species in the instar preceding maturity. Adults from that locality were at the same time correctly assigned by that author. (Trans. Am. Ent. Soc., XLII, p. 218, 1916.)

Euborellia annulipes (H. Lucas).

1847. *Forficelisa annulipes* H. Lucas, Bull. Soc. Ent. France, (2), V, p. LXXXIV. [Jardin des Plantes, Paris, France, (probably introduced).]

Montevideo, Uruguay, 2 ♀.

Euborellia peregrina (Mjöberg).

1904. *Anisolabis peregrina* Mjöberg, Ent. Tidsk. Stockholm, 1904, p. 131. [♀; Stockholm, Sweden, introduced from St. Anna, Matto Grosso, Brazil.]

St. Laurent du Maroni, French Guiana, XII, 1 ♀. Nouveau Chantier, French Guiana, XII, 1 ♀.

The two females at hand agree in all important features with the original description. We would note that the cephalic tibiae, in addition to being well supplied with hairs distad on all but the dorsal surface, have the distal margin ventrad armed with a very closely placed fringe of chaetiform spines; these, due to the size of this species, being more conspicuous than in specimens of the other species of *Euborellia* at hand.

Length of body (exclusive of forceps) 16.9 and 17.8; greatest width of head, 2.6 and 2.8; length of pronotum, 2.7 and 2.7; cephalic width of pronotum, 2.3 and 2.6; caudal width of pronotum, 2.7 and 3; length of forceps, laterally 3.3 and 3.7, dorsally 2.8 and 3 mm.

For the type female the total length is given as 23, the length of the forceps as 3 mm.

Euborellia scudderi (Bormans).

1900. *Ps[alis] scudderi* Bormans, Ann. Mus. Civ. Stor. Nat. Genova, (2), XX, p. 449. [♀; Puerto 14 de Mayo, Upper Paraguay (now in Bolivian Chaco); Olivenza, Amazon River (Brazil).]

St. Jean du Maroni, French Guiana, V, 1 ♀.

Length of body 10, length of pronotum 1.3, length of tegmen 2.2, length of exposed portion of wing 1.6, length of forceps 1.7 mm.

This specimen has fully developed tegmina and wings, but agrees so closely with material in the Philadelphia Collections which we believe to represent this species, showing a varied development of the organs of flight, that we make the present assignment feeling assured that we here have to deal with a species which develops a remarkably wide range of tegminal and wing variation.

The present specimen agrees closely with a female from Porto Velho, Rio Madera, Brazil,² except that in that specimen the tegmina and exposed portions of the wings are not as elongate. Both of these specimens have the femora more generally and not as contrastingly darkened as the specimens having short tegmina and no

² Recorded by Rehn as *Psalis* sp. Trans. Am. Ent. Soc., XLII, p. 219, (1916).

apparent wings at hand. In addition they are slightly more robust, with shorter and more truncate pronotum than the specimens recorded by Rehn from Pará, Brazil,³ but agree fully in these respects with the original description, as well as with specimens from Chanchamayo, Peru, before us, which show even greater tegminal reduction than the Pará individuals.

***Labidura riparia* (Pallas).**

1773. *Forficula riparia* Pallas, Reise Russischen Reichs, II, Buch 2, Anhang. p. 727. [♂; shores of Irtysh (Irtin) River, western Siberia.]

Rio de Janeiro, Brazil, 1 ♂.

***Labidura xanthopus* (Stål).**

1855. *F[orficelisa] xanthopus* Stål, Ofv. Vet. Akad. Förh., XII, p. 348. [Rio de Janeiro, Brazil.]

San Ignacio, Misiones, Argentina, III and IV, 1 ♀. Tucuman, (border of Rio Chilimayo), Argentina, 2 ♀. Icaño, Santiago del Estero, Argentina, 2 ♀.

The females from the last locality alone have the wings visible and fully developed. These have the pronotum proportionately smaller and distinctly more slender than the others.

LABIIDAE.

SPONGIPHORINAE.

***Purex formosus* new species. (Plate XIII, figs. 1 and 2.)**

This handsome species appears to be widely distinct from the other known forms of the genus, agreeing in certain features of coloration more closely with *brunneri* (Bormans), from the upper Amazon, than with the others.

The male pygidium, though more highly specialized and much more declivent, recalls the type developed in *Vostox brunneipennis* (Serville), (see plate XIII, fig. 3).

The male forceps show a much weaker curvature than is developed in several species of *Purex* and are distinctive in having a heavy median and smaller uncinat proximal tooth on the ventro-internal margin.

Type—♂; Gourdonville, French Guiana. October. [Paris Museum.]

Size medium, form slender. Head depressed, broadly convex surface between eyes showing two small and weak impressions,

³ As *Psalis scudderi* with a query. Trans. Am. Ent. Soc., XLII, p. 218, (1916).

sutures obsolete; very weak but distinct depressions run from the eyes toward the middle of the caudal margin of the occiput; cheeks almost as long as eyes, caudal margin of occiput very broadly and weakly concave. Antennae with first joint three times as long as distal width, enlarged in distal three-fifths; second joint very small; third joint three-fifths as long as first; fourth slightly shorter; succeeding joints increasing regularly in length and slenderness distad. Pronotum small, three-quarters as broad as head, longer than wide, lateral margins almost straight and showing an almost imperceptible divergence caudad, caudal margin rather strongly convex; surface of prozona weakly convex and showing a faint medio-longitudinal linear sulcus, other portions deplanate except narrowly toward the lateral margins where they are obliquely raised. Tegmina very wide at shoulders where their combined width is slightly less than twice the pronotal width, their length over twice that of pronotum, narrowing evenly caudad, with caudal margins weakly oblique. Wings fully developed, exposed portion nearly one-third as long as tegmen. Abdomen widening moderately to distal portion, glands of second and third tergites moderately prominent. Ultimate tergite very slightly produced between forceps, caudal margin laterad weakly concave and very weakly oblique, mesad straight, transverse. Between the base of each arm of the forceps and the transverse portion of the caudal margin, this tergite is inflated, weakly convex, being depressed about these areas externally and in the entire median area between them. Pygidium almost perpendicular, as long as wide, lateral margins straight and parallel, latero-distal margins weakly concave, oblique to the minute medio-distal portion which is produced in a minute bi-denticulate projection, the angles formed by the lateral and latero-distal margins also each produced in a slightly larger denticulation. Forceps feebly divergent in proximal fourth, thence almost straight to near the incurved apices, moderately heavy proximad, tapering gently to apices; dorsal surface deplanate to near distal portion, with delicate rounded ridge bordering the external margin; internal surface flattened, unarmed except for a small ventro-proximal uncinat tooth, with apex directed caudad, and just before the middle with a heavy and moderately large triangular ventral tooth, directed meso-ventrad. Caudal margin of penultimate sternite transverse. Caudal metatarsus with ventral surface well supplied with fine hairs, combined length of two succeeding joints about three-quarters that of metatarsus.

Length of body 8⁴., greatest width of head 1.25, length of pronotum .95, length of tegmen 2.1, greatest width of abdomen 1.7, length of forceps 2.8 mm.

Head blackish chestnut brown. Antennae with first two joints prouts brown, succeeding joints paler, buckthorn brown, deepening rapidly to mummy brown, which is the color of the seventh to tenth joints (remaining joints missing). Pronotum and limbs immaculate ochraceous-buff tinged with tawny. Tegmina chestnut brown, showing weakly the paler pronotal coloration at the shoulders and distad, with a small oval of the same coloration mesad, this oval half on the tegmina and half on the exposed portions of the wings and as long as the tegminal width at that point (compare *brunnei*), remaining exposed portion of wings chestnut brown. Abdomen dorsad russet tinged with cinnamon-brown distad, except laterad about the glands where it is blackish chestnut brown. Forceps russet tinged with cinnamon-brown.

The type of this graceful little insect is unique.

***Vostox punctipennis* (Stål)**

1860. *Forficula punctipennis* Stål, Kongl. Svenska Freg. Eugenie's Resa, Ins., p. 304. [♂; Rio de Janeiro, Brazil.]

Icaño, Santiago del Estero, Argentina, 1 ♂.

Stål's *punctipennis* has been placed under *V. brunneipennis* (Serville) by Burr. The specimen before us represents a species very close to *brunneipennis* but readily distinguished by a number of features. Though Stål's description of *punctipennis* does not give the most important of these, we believe that the species represented by the specimen at hand is the same, and in consequence we restore the name *punctipennis*.

Compared with material of *brunneipennis* from the United States, the present male is seen to differ in the following respects. Cheek much shorter, two-fifths instead of two-thirds as long as eye. Exposed portion of wings about half as long as tegmen, instead of distinctly less than half that length. Pygidium with marginal flange narrower, lateral points more acute and distal truncation narrower. Median and caudal femora and tibiae heavily suffused with brown mesad.

Length of body 8.3, length of pronotum 1.7, caudal width of pronotum 1.6, length of tegmen 2.9, length of exposed portion of wing 1.5, length of forceps 3.8 mm.

⁴As elsewhere in this paper, the body length given does not include the length of the forceps.

*Spongovostox berlandi*⁴ new species (Plate XIII, figure 4.)

This species bears *Vostox brunneipennis* (Serville) a general superficial resemblance. The males at hand are, however, readily distinguished by the cheeks, which are longer than the eyes; the tegmina, which are keeled; the femora, which are suffused proximad; the pygidium of generally similar form but more declivent, with disto-lateral oblique margins much more transverse and not at all emarginate, and forceps, which show a greater inward curvature distad and have the larger tooth of the internal margin proximad, not at the end of the proximal third.

Type: ♂; Guatemala City, Guatemala. [Paris Museum.]

Size medium for the genus, form weakly depressed. Head showing a moderate depression from eyes to median point of caudal margin, occipital lobes prominent, so that cheeks are longer than eyes and caudal margin of occiput broadly angulate emarginate, sutures obsolete. Antennae with first joint moderately large, broadening so that the distal two-thirds are the more ample; second joint minute; third nearly as long as first, but much more slender; fourth half as long as third, slightly longer than greatest width; fifth intermediate in length between third and fourth; sixth as long as third. Pronotum very slightly longer than caudal width, smooth, showing a very weak medio-longitudinal linear sulcus, lateral and caudal margins showing a very slight convexity, the former showing a very feeble convergence cephalad; prozona tumid, metazona weakly concave proximo-laterad and very feebly convex mesad, elsewhere deplanate. Tegmina smooth, with a very fine but distinct and percurrent keel along the external margin of the dorsal surface, transverse truncate caudad. Wings fully developed, exposed portion about two-fifths as long as tegmen. Abdomen with dorsal surface polished but microscopically punctulate, fourth and fifth tergites showing laterad a weak rounded carina, these tergites there slightly produced caudad. Ultimate tergite very weakly depressed meso-caudad, caudal margin almost evenly transverse. Pygidium very strongly declivent, with surface in a broad triangular dorsal area deplanate, thence convex; lateral margins fitting forceps tightly, latero-caudal margins very strongly convergent, almost transverse to a broad, weakly produced median portion which is truncate. Forceps elongate, showing a very feeble curva-

⁴We take pleasure in naming this interesting species in honor of Monsieur Lucien Berland, Curator of Insects of the Muséum National d'histoire Naturelle, Paris.

ture, which is stronger toward their incurved apices, with a few irregular blunt denticulations proximad on the internal surface particularly along the ventral margin, of which that on the ventral margin opposite the apex of the pygidium is the largest. Penultimate sternite simple, its caudal margin transverse, showing a sub-obsolete concavity. Caudal metatarsus with ventral surface well supplied with hairs and with an internal fringe of lamellae, second joint very short.

Length of body⁶ 8. and 7.8, width of head, 1.6 and 1.6, length of pronotum 1.7 and 1.7, width of abdomen 2.3 and 2.3, length of forceps 3.3 and 3.4 mm.

Coloration. Entire insect glabrous. Head and pronotum dark chestnut brown, the pronotum laterad becoming chestnut brown, mouthparts and proximal antennal joints ochraceous-tawny, the antennae thence cinnamon-brown. Tegmina chestnut brown. Exposed portions of wings warm buff, except distad and along sutural margins where they are chestnut brown. Abdomen dark chestnut brown. Forceps proximad and distad russet, becoming very dark mesad. In the paratype the russet invades the ultimate tergite. Limbs honey yellow, the femora suffused with prouts brown proximad.

In addition to the type, a paratypic male bearing the same data is before us.

*Spongovostox asemus*⁷ new species (Plate XIII, figure 5).

This species is in many respects a smaller replica of *S. berlandi* here described. From that species it is readily distinguished by the tegmina which are not keeled, the more slender abdomen and distinctive male pygidium and forceps which latter have a heavier denticulation of the internal surface with a more conspicuous proximal tooth.

The form of the pygidium agrees closely with that figured by Burr as of *Spongovostox ghilianii* Dohrn var.⁸

We believe that the material examined by Burr represents one or more distinct species. Burr's characterization does not agree with the original description of *ghilianii* ("pygidium ♂ longe productum, postice rotundatim") and his type designation "Venezuela (Moritz, Typus von Dohrn)" consequently does not hold. As part at

⁶ The measurements of the type are given first.

⁷ From ἀσημος = insignificant.

⁸ Ann. k. k. Naturhist. Hofmus. Wien. XXVI, p. 335, fig. 9, (1912).

least of the material which was before Burr may represent the present species, we feel it advisable to fix the name *ghiliani*. We do so, therefore, by selecting the type locality of *Labia ghiliani* Dohrn as Pará, Brazil. The material which Dohrn had from that locality was collected by Ghiliani and it is reasonable to suppose was that actually used in describing the species named in honor of that collector.

The heavier structure and broad head and pronotum distinguish this insect from the species *Microvostox*, in addition to its having a more deplanate head with evident sutures.

Type: ♂; San Ignacio, Misiones, Argentina. [Paris Museum.]

Size small for the genus, form moderately depressed. Head very weakly depressed in area bounding the very weakly defined occipital lobes, cheeks longer than eyes, caudal margin of occiput almost evenly transverse, sutures very fine but distinct. Antennae with first joint more elongate and slender than in *berlandi*, broadening so that the distal half is somewhat the more ample; second joint minute; third three-quarters as long as first, slender, cylindrical; fourth joint slightly over half as long as third, slightly longer than greatest width; fifth joint intermediate in length between third and fourth; sixth joint as long as third. Pronotum smooth, showing a very weak medio-longitudinal sulcus, length equal to width, lateral margins almost straight, parallel, caudal margin showing a very slight convexity; prozona tumid, metazona almost deplanate, showing a very feeble convexity meso-proximad. Tegmina smooth, without trace of keel, truncate caudad. Wings fully developed, exposed portion about half as long as tegmen. Abdomen as in *berlandi* except that it is more slender. Ultimate tergite rather heavily punctulate except in meso-proximal section, with a weak medio-longitudinal depression, caudal margin almost evenly transverse. Pygidium strongly declivent, dorsal surface tapering with a strong convexity to apex, which is briefly produced and truncate. Forceps much as in *berlandi* except that the denticulations of the internal surface are heavier both dorsad and ventrad, extending to distal portion, with proximal tooth median in vertical position and projecting as a small quadrate process, higher than wide, above the pygidial apex on each side. Penultimate sternite with lateral portions of caudal margin convex, these forming mesad a rounded obtuse-angulate emargination.

Length of body 7.5, width of head 1.1, length of pronotum 1, greatest width of abdomen 1.7, length of forceps 2.6 mm.

Coloration. Entire insect glabrous. Head mummy brown, mouthparts and proximal antennal joints dresden brown, the antennae deepening to prouts brown. Pronotum mummy brown shading to buffy caudad, lateral portions buffy. Tegmina mummy brown, paler toward the external margins. Exposed portions of wings broadly suffused with mummy brown along sutural margin and distad, narrowly suffused with the same color along distal portion of costal margin, remaining portions buffy. Abdomen cinnamon brown, deepening to dark chestnut brown proximo-laterad on proximal portions of tergites, the ultimate tergite entirely of this color. Pygidium and forceps dark chestnut brown, the latter paling to dresden brown in proximal portion. Limbs suffused buffy.

The type is unique.

Microvostox parvus (Burr)

1912. *Spongovostox parvus* Burr, Ann. k. k. Naturhist. Hofmus. Wien, XXVI, p. 336, fig. 12. [♂: Tapanokoni, Dutch Guiana (type); Georgetown, British Guiana.]

Cartago, Costa Rica, 1600 meters, (C. Picado), 1 ♂.

The present specimen agrees fully with Burr's figure and very short analysis except in size.⁹ Length of body 5.3, length of pronotum, .6, caudal width of pronotum .7, length of tegmen 1.2, length of exposed portion of wing, .6, length of forceps 1.8 mm.

It belongs to the same species group as *bilineatus* (Scudder) and *pygmaeus* (Dohrn), differing from the genotype, *alter* (Burr), and other forms of that species group, in the more flattened head, which shows a closer approach to the type developed in the genus *Spongovostox*.

Microvostox chopardi¹⁰ new species (Plate XIII, figures 6 and 7.)

This species is apparently closely related to Borman's *Spongiphora similis*.¹¹ Compared with the original description of the male of that species, the male before us is found to differ in the smaller size, broader pale coloration of the lateral and caudal margins of the pronotum, longer exposed portion of wings, entirely blackish limbs

⁹ The type is given as 3.5 mm. long, the forceps 1.5 mm. It is possible that when comparison with the type of *parvus* can be made, the specimen here recorded may prove to be specifically distinct.

¹⁰ We take great pleasure in naming this handsome little species in honor of our distinguished friend Monsieur Lucien Chopard, whose excellent contributions to the literature treating of Orthoptera are a constant source of pleasure to us.

¹¹ Though that species has been referred by Burr to the genus *Vostox*, we believe that examination of the type will show it to be a member of our subsequently described genus *Microvostox*.

and in the pygidium and forceps which, though of very similar general structure, show important differences. The former being merely subconical mesad in the convex area, the latter in having the internal margins entirely unarmed distad.

Type: ♂; Nouveau Chantier, French Guiana. August. [Paris Museum.]

Size medium, form moderately broad, for this genus which includes very small species. Head depressed and showing weak but distinct depressions which run from the eyes toward the middle of the caudal margin of the occiput, cheek one and one-half times as long as eye, caudal margin of occiput showing very broad and weak concavity, sutures obsolete. Antennae with first joint twice as long as distal width, other joints missing. Pronotum with length equal to width, very slightly broader cephalad than caudad, showing a weak medio-longitudinal sulcus and on the prozona a lateral sulcus on each side; lateral margins very broadly convex and very weakly convergent caudad, rounding broadly into the very broadly convex caudal margin. Tegmina slightly over twice as long as broad, caudal margin transverse. Wings fully developed, exposed portion nearly half as long as tegmen. Abdomen with dorsal surface polished and punctulate laterad except ultimate tergite which is smooth, shows a very feeble median depression and has its caudal margin transverse. Pygidium moderately declivent, surface convex becoming subconical mesad with a minute medio-longitudinal carina running down the caudal face of this production, lateral margins weakly convex, with a minute tubercle on each side just beyond the median point where these margins no longer touch the forceps, distal margin transverse, as broad as basal margin, with a small rounded tooth at each disto-lateral angle. Forceps straight, slightly divergent and weakly tapering in proximal half, with a few microscopic tuberculations on the internal face opposite the pygidium, inbent at end of proximal half, the distal half more slender but gently swollen meso-distad, almost straight to the slightly incurved apices and wholly unarmed. Penultimate sternite and tarsi wholly concealed by mounting slip.

Length of body 5.2, greatest width of head (across eyes) .9, length of pronotum .75, greatest width of abdomen 1.5, length of forceps 1.3 mm.

Head dull black, proximal antennal joints dresden brown. Pronotum shining blackish brown, broadly margined laterad and caudad with translucent whitish. Tegmina shining blackish brown, show-

ing a longitudinal buffy tinge on the shoulders. Exposed portion of wings shining, blackish brown toward sutural margin, remaining half warm buff. Dorsal surface of abdomen shining blackish, showing a rich chestnut tinge mesad. Forceps shining blackish brown with a rich chestnut tinge. Limbs shining blackish brown.

The type of this remarkable species is unique.

Microvostox ghilianii Dohrn.

1864. *L[abia] ghilianii* Dohrn, Stett. Ent. Zeit., XXV, p. 424. [♂, ♀: Para,¹² (Brazil); Cayenne, (French Guiana); Venezuela.]

Charvien, lower Maroni River, French Guiana, V, 1 ♂.

From examination of this specimen, which appears to agree fully with the description of *ghilianii*, we find *M. schwarzi* (Caudell) to be a very closely related species, differing only in its decidedly broader form. As a result the pronotum of the present species is distinctly smaller in proportion to its body length, while the tegminal width is contained in the tegminal length three times. In males of *schwarzi* the tegminal width is contained in the tegminal length about two and one-half times. The male genitalia in these species show no diagnostic differences whatever.

These species, as well as the genotype, *M. alter* (Burr), belong to a species group having the head more strongly and evenly convex, strongly suggesting the type usually encountered in the genus *Labia*.

LABIINAE.

Labia arcuata Scudder.

1876. *Labia arcuata* Scudder, Proc. Bost. Soc. Nat. Hist., XVIII, p. 257. [♂; Vassouras, one hundred miles north of Rio de Janeiro, Brazil.]

St. Jean du Maroni, French Guiana, III, 1 ♂. St. Laurent du Maroni, French Guiana, XII, 1 ♂, 1 ♀.

Labia dorsalis (Burmeister)

1838. *Forficula dorsalis* Burmeister, Handb. Ent., II, abth. II, pt. I, p. 754. [Colombia.]

Guadeloupe, West Indies, 1 ♂. St. Jean du Maroni, French Guiana, V, 2 ♂, 2 ♀. St. Laurent du Maroni, French Guiana, I and XII, 2 ♂, 2 ♀.

Prolabia unidentata (Beauvois)

1805. *Forficula unidentata* Beauvois, Ins. Recueil. Afr. Amér., p. 165, pl. XIV, fig. 3. [San Domingo.]

Port au Prince, Haiti, 1 ♂. San Jaun, Porto Rico, 1 ♀.

¹² Selected as the type locality on page 345, under the discussion of *Spongovostox asemus* new species. It would appear very probable, from the literature and Burr's figure, that the material recorded by Dohrn represented more than one species.

SPARATTINAE.

Sparatta semirufa Kirby (Plate XIII, figure 8.)

1896. *Sparatta semirufa* Kirby, Jn. Linn. Soc. London, Zool., XXV, p. 528, pl. XX, figs. 4 and 4a. [[♂]; Igaurassu, near Pernambuco, Brazil.]

French Guiana, 1 ♂. St. Jean du Maroni, French Guiana, 1 ♀.
St. Laurent du Maroni, French Guiana, 1 ♀.

These specimens agree closely and are clearly conspecific with the specimen from Pará, Brazil, referred tentatively to *semirufa* by Rehn. Kirby's descriptions of species of this genus are thoroughly unsatisfactory as to sex¹³ and details of genitalia, hence determinations can not be made with full satisfaction until the material from which that author described *semirufa* has been studied. Kirby's figures agree fully with the females before us, the genitalia of the male at hand are here figured.

All of the specimens we have seen are apparently paler than Kirby's material. In these the pronotum, limbs, proximal portion of tegmina and proximal portion of abdomen are immaculate ochraceous buff, the head and antennae tinged with rosy.

Parasparatta guyanensis new species (Plate XIII, figures 9 and 18).

This species is related to the Mexican *P. dentifera* (Rehn) and the Brazilian and Paraguayan *P. nigrina* (Stål).¹⁴ With the former it agrees in abdominal coloration and form of male pygidium, with the latter in antennal and limb coloration.

The male forceps bear two teeth on each branch, as do those of *nigrina*, but the position of these teeth is not the same, being more nearly that of the two more distal teeth in *dentifera*.

In the female, unlike in females of *dentifera*, the pygidium has the ventral lamellate area completely visible from above, while the forceps lack a proximo-internal lamellation.

Type: ♂; St. Jean du Maroni, French Guiana. April and May. [Paris Museum.]

Size and form as in *dentifera*. Head greatly depressed, conventional heart-shaped, the caudal margin rather strongly concave; eyes very small, sutures obsolete. Antennae with first joint nearly four times as long as broad; second joint minute; third joint slightly

¹³ Either Kirby mistook a female for a male when describing *semirufa*, or the material before us represents a distinct species. We do not believe the latter to be true.

¹⁴ See Borelli's excellent comparison of these species in Boll. Mus. Zool. Anat. comp. Univ. Torino, XXX, No. 699, p. 3, (1915). Also discussion by Hebard, Trans. Am. Ent. Soc., XLIII, p. 420, (1917).

over half as long as first; joints immediately succeeding increasing strongly in length distad. Pronotum as typical of genus, flattened, longer than broad, briefly produced cephalad to form a collar which is delimited by a delicate transverse sulcus, this produced area not as long as in *Sparatta*, with lateral margins very feebly convex and nearly parallel and caudal margin moderately convex. Tegmina and wings fully developed, thickly supplied with minute hairs. Dorsal surface of abdomen similarly hairy, except ultimate tergite which is smooth dorsad and has a U-shaped impressed line. Pygidium as in *dentifera*, a produced shaft, three times as long as basal width, with dorsal surface convex, the lateral margins weakly convex, so that it is narrowest meso-proximad, the disto-lateral angles produced in acute points, the distal portion between these produced caudad in a square median lamella. Forceps hairy, with shaft almost straight to distal third where it curves evenly and rather weakly inward to the flattened acute apex; internal surface concave in slightly over proximal two-fifths, the ventral margin there supplied with minute and irregular denticulations terminated by a large tooth directed meso-caudad, armed at end of proximal four-fifths with another similar tooth which, however, is dorsal in vertical position and is directed mesad. Penultimate ventral sternite with caudal margin weakly bilobate. Caudal metatarsus as long as third tarsal joint, supplied ventrad with an external row of widely spaced minute spines and an internal very close fringe of spinuliform hairs.

Allotype: ♀; same data as type. [Paris Museum.]

Agrees closely with male except in the following features. Ultimate abdominal tergite longer, its median length equal to its caudal width. Pygidium small, with dorsal surface convex and very strongly declivent, the distal (caudal) portion produced in a lamella shorter than wide, the lateral margins of this lamella straight and divergent in brief proximal portion, thence concave and showing no divergence to the apices, caudal margin straight mesad, convex to the acute apices laterad; these margins resultantly forming a minute proximal denticulation on each side and two large, slightly recurved horns at the disto-lateral extremities.

Head (except mouthparts), pronotum, tegmina, exposed portions of wings and dorsal surface of abdomen (except ultimate tergite) blackish, shining, showing a very slight brown tinge. Mouthparts dresden brown. Antennae entirely blackish brown. Ultimate tergite of abdomen tawny (ochraceous-tawny in recessive specimens), shining, the dorsal surface of the abdomen having, in some

specimens, the preceding distal tergites tinged with tawny distad as well. Pygidium and forceps mars brown. In one recessive example with pygidium light ochraceous-tawny and forceps mars brown, in another with pygidium and forceps ochraceous-tawny. Limbs in intensive specimens blackish mummy brown, paling slightly to prouts brown distad. In the majority of examples the femora and tibiae are mummy brown paling to dresden brown distad, the tarsi dresden brown.

Measurements (in millimeters)

		Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Length of forceps
♂						
St. Jean du Maroni. <i>Type</i> ..	8.	1.2	.9	1.8	2.9	
Charvien. <i>Paratype</i>	7.8	1.25	.9	1.8	3.	
Nouveau Chantier. <i>Para-</i> <i>type</i>	7.9	1.25	.9	1.8	3.2	
♀						
St. Jean du Maroni. <i>Allo-</i> <i>type</i>	8.1	1.2	.95	1.8	2.7	
Charvien. <i>Paratype</i>	8.3	1.3	1.	1.8	2.8	
Nouveau Chantier. <i>Para-</i> <i>type</i>	7.2	1.2	.9	1.8	2.9	

Coloration is apparently of considerable specific diagnostic value in this and allied species, but can not safely be used without full consideration of the structural details, a frequent fault in past literature.

In addition to the described pair, we have before us eight paratypes from French Guiana. Of these one pair are from Nouveau Chantier, taken in May; one pair from Charvien, taken in October and November, the other four females without additional data.

Parasparatta dentifera (Rehn)

1901. *Sparatta dentifera* Rehn, Trans. Am. Ent. Soc., XXVII, p. 218.
[♀; Orizaba, Vera Cruz, Mexico.]

Guatemala City, Guatemala, 2 ♀.

One of these specimens is smaller than the other, with specialization of the forceps less decided. Such variation is frequently encountered in this and allied species.

FORFICULIDAE.

FORFICULINAE.

Skalistes lugubris (Dohrn)

1862. *Forficula lugubris* Dohrn, Stett. Ent. Zeit., XXIII, p. 230. [Cordoba, (Vera Cruz) Mexico.]

Sierra de Tlalpujahu, near Toluca, Mexico, Mexico, 2400 to 2700 meters, 1 ♂, 1 juv. Vicinity of Guadalajara, Jalisco, Mexico, XI, 1 ♀.

Skalistes inopinata (Burr)

1900. *Ancistrogaster inopinata* Burr, Ann. Mag. Nat. Hist., (7), VI, p. 85. [♂, ♀; Costa Rica.]

Antigua, Department of Sacatepequez, Guatemala, 1400 meters, 1 ♂, 1 ♀.

The length of the forceps in the present male is 3.7 mm.

Though *inopinata* has been referred by Burr to synonymy under *S. lugubris* (Dohrn), we believe it to be a very distinct species. We have not as yet seen Mexican material referable to *S. cornuta* (Burr), which name may prove a synonym of *inopinata*.

Doru lineare (Eschscholtz)

1822. *Forficula linearis* Escholtz, Entomogr., p. 81. [Santa Catharina, Brazil.]

Huejotitlan, Jalisco, Mexico, 1700 meters, VI, VII and XI, 3 ♂, 1 ♀. Guatemala City, Guatemala, 2 ♂, 2 ♀. Curityba, Parana, Brazil, 2 ♀. Gran Chaco, Argentina, 2 ♀. Villa Lutecia, near San Ignacio, Misiones, Argentina, I to IV, 2 ♂, 5 ♀. Icaño, Santiago del Estero, Argentina, XII, 5 ♂, 6 ♀.

Two of the females from Villa Lutecia lack apparent wings. These specimens have the pronotum slightly larger, but in other respects agree perfectly with the other females of the series.

NEOLOBOPHORINAE.

Neolobophora ruficeps (Burmeister)

1838. *F[orficula] ruficeps* Burmeister, Handb. Ent., II, abth. II, pt. I, p. 755. [Mexico.]

Antigua, Department of Sacatepequez, Guatemala, 1400 meters, 1 ♀.

This specimen has the tegmina impresso-punctate.¹⁵

OPISTHOCOSMIINAE.

Neocosmiella atrata Hebard.

1919. *Neocosmiella atrata* Hebard, Trans. Am. Ent. Soc., XLV, p. 96, pl. XVI, fig. 4. [♂: Pamplona, Santander, Colombia.]

Pamplona, Santander, Colombia, 1 ♂.

The specimen here recorded agrees fully with the type of this interesting species.

¹⁵ See discussion by Hebard, Trans. Am. Ent. Soc., XLIII, p. 424, (1917).

EXPLANATION TO PLATE XIII.

- Fig. 1.—*Purex formosus* new species. ♂, *type*. Gourdonville, French Guiana. Dorsal view of ultimate tergite, pygidium and forceps. ($\times 7\frac{1}{2}$).
- Fig. 2.—*Purex formosus* new species. ♂, *type*. Gourdonville, French Guiana. Dorsal view of pygidium. (Greatly enlarged.)
- Fig. 3.—*Vostox brunneipennis* (Serville). ♂. Arcadia, Louisiana. Dorsal view of pygidium. (Greatly enlarged.) (For comparison with figures 2 and 4.)
- Fig. 4.—*Spongovostox berlandi* new species. ♂, *type*. Guatemala City, Guatemala. Dorsal view of pygidium. (Greatly enlarged.)
- Fig. 5.—*Spongovostox asemus* new species. ♂, *type*. San Ignacio, Misiones, Argentina. Dorsal view of ultimate tergite, pygidium and forceps. ($\times 12\frac{1}{2}$).
- Fig. 6.—*Microvostox chopardi* new species. ♂, *type*. Nouveau Chantier, French Guiana. Dorsal view. ($\times 8\frac{1}{2}$).
- Fig. 7.—*Microvostox chopardi* new species. ♂, *type*. Nouveau Chantier, French Guiana. Dorsal view of pygidium. (Greatly enlarged.)
- Fig. 8.—*Sparatta semirufa* Kirby. ♂. St. Jean du Maroni, French Guiana. Dorsal view of ultimate tergite, pygidium and forceps. ($\times 7\frac{1}{2}$).
- Fig. 9.—*Parasparatta guyanensis* new species. ♂, *type*. St. Jean du Maroni, French Guiana. Dorsal view of ultimate tergite, pygidium and forceps. ($\times 10\frac{1}{2}$).
- Fig. 10.—*Parasparatta guyanensis* new species. ♀, *allotype*. St. Jean du Maroni, French Guiana. Dorsal view of ultimate tergite, pygidium and forceps. ($\times 10\frac{1}{2}$).

**ORDOVICIAN BASALTS AND QUARTZ DIABASES IN LEBANON COUNTY,
PENNSYLVANIA¹**

SAMUEL G. GORDON.

As no Paleozoic volcanic rocks have hitherto been discovered in Pennsylvania, the occurrence of an Ordovician basalt flow in Lebanon County is of interest, especially in view of the fact that deep seated intrusives occur in the Octoraro schists of similar age to the southeast.²

The basalts and quartz diabases described below occur in the Lebanon quadrangle, just south of the Swatara Creek, between Jonestown and Lebanon (see Fig. 1). The area is underlain by a thick series of Martinsburg shales, whose outcrop has been considerably extended in width by folding and faulting. Intrusive in it are sills and dikes of quartz diabase, to the northwest of which lie the interbedded basalt flows.

Martinsburg Formation. The Martinsburg formation consists of a thick series of gray, greenish, and reddish shales, with interbedded sandstones, and thin beds of dolomite,—the last notably in the vicinity of the Swatara. A white sandstone is exposed on the Bunker Hills. Slaty cleavage has been developed in the shales. The formation has been overturned, dipping steeply toward the southeast throughout this area.

In the vicinity of the intrusive diabases, the shales have been metamorphosed to dense dark grayish, greenish, or reddish rocks containing veins of epidote or vesuvianite. Such rocks are well exposed just south of the Swatara, 2 miles southeast of Jonestown, and one half mile east of Bunker Hill Station in a cut on the Jonestown-Lebanon road. Under the microscope the rocks are seen to be aggregates of orthoclase, tremolite, epidote, vesuvianite, chlorite, quartz, and rounded zircons.

¹ The district was visited during the latter part of August, 1920. The writer is indebted to Mr. Frank J. Keeley for the privilege of examining his sections of other Pennsylvania diabases, and to Dr. Edgar T. Wherry for a critical examination of this paper.

² Basic breccia (ouachitite) and dikes of nepheline syenite, leucite tinguaitite, and camptonite of Post-ordovician age occur in the northwestern corner of the Franklin Furnace quadrangle, New Jersey. U. S. G. S. Franklin Furnace Folio, 162, 1908.

Quartz Diabase. The quartz diabases form minor wooded ridges, rising above the country occupied by the softer shales in which they occur as sills and dikes. The exposures consist chiefly of enormous boulders, many of which have travelled slowly down the hillsides, and have been collected from the fields by the farmers to form stone

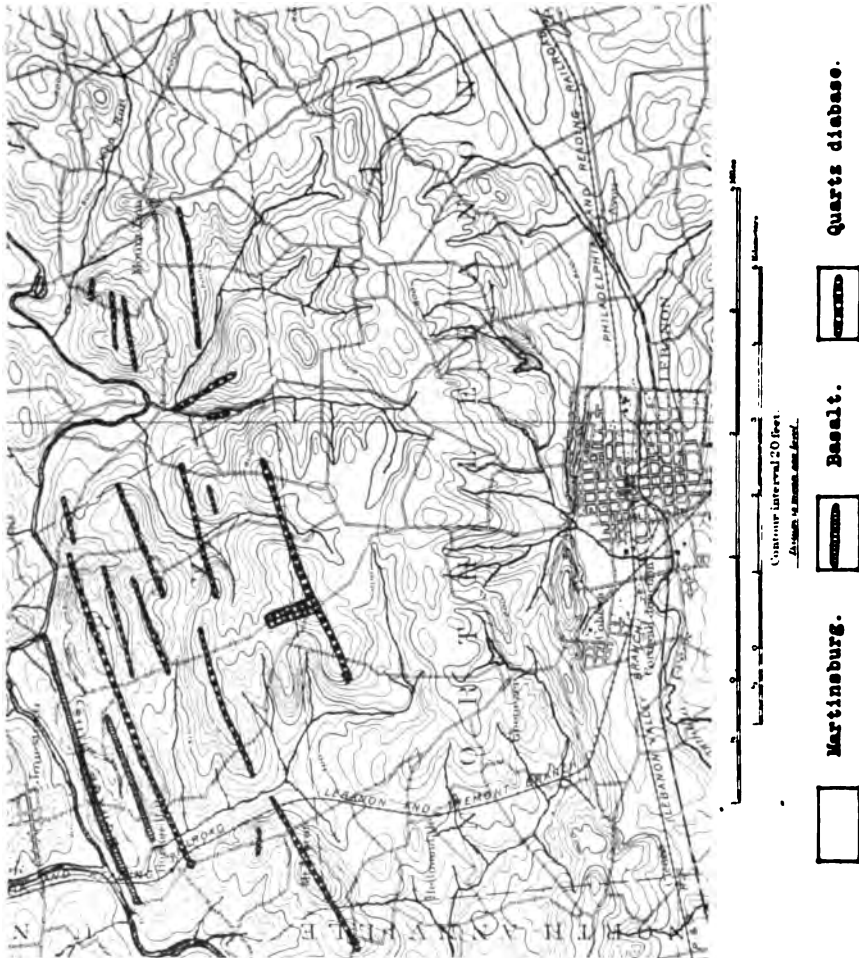


Fig. 1.—Ordovician Basalts and Quartz Diabases of Lebanon County, Pennsylvania.

fences. When the need for road metal arose, these rocks, locally known as "iron-stone," have been crushed.

The quartz diabase (Fig. 2.) is typically a fine-grained, dark greenish black or mottled black and gray rock, which may become



2



3



4



5

Fig. 2.—Quartz diabase, three miles northwest of Lebanon. (Slide 1, $\times 15$). Structure ophitic; laths of labradorite, euhedral augite, with interstitial graphic intergrowths of quartz and orthoclase.

Fig. 3.—Edge of fragment of basalt in glass, separated by a vein of calcite. One mile southwest of Jonestown. (Slide 19, $\times 15$).

Fig. 4.—Basalt glass, amygdaloidal; one mile southwest of Jonestown. (Slide 20, $\times 25$). Shows perlitic structure in the glass, and a calcite amygdule (white).

Fig. 5.—Amygdule of quartz in basalt; one mile southeast of Jonestown. (Slide 27, $\times 25$).

All in ordinary light.

quite fine-grained at the contacts. Three miles northwest of Lebanon, the quartz diabase is porphyritic, with black augite phenocrysts up to 1 cm. in length, in labradorite.

The texture is diabasic or ophitic. The labradorite is quite zoisitized, and the associated augite is more or less altered to chlorite, all stages of the alteration from incipient changes along cleavage cracks to complete chloritized individuals being shown in thin section. Graphic intergrowths of quartz and orthoclase form interstitial aggregates. Magnetite and pyrite are the principal accessory minerals, the latter being recognizable in most hand specimens.

Basalt. The basalts are exposed along the Swatara Creek, on the north slope of Bunker Hill, along the railroad cut one half mile north of Bunker Hill Station, and in the road cut one half mile east of Bunker Hill Station.

The rock is chiefly a brecciated or tuffaceous amygdaloidal basaltic glass, indicating that the flow occurred under water on the floor of the Ordovician sea. The brecciated character is well shown on weathering, which also causes the rock to assume a vesicular appearance due to the weathering out of the calcite amygdules.

Freshly broken specimens show angular fragments of dense black glass in an aggregate of greenish glass and calcite amygdules. On weathering the rock becomes dark yellow. The most typical basalt occurs two miles southeast of Jonestown, where it forms a dense crystalline rock, with amygdules of calcite, or more rarely, of quartz.

Under the microscope, the basalt breccia (Figs. 3-5) is seen to be composed of greenish glass ($n < 1.60$) showing perlitic structure, which exhibits strain effects or incipient crystallization under crossed nicols. The glass is filled with inclusions, and larger fragments of crystalline basalt, consisting of aggregates of plagioclase laths and augite in a dark glassy groundmass, similar to the crystalline basalt, two miles southeast of Jonestown.

ADDITIONAL NOTES ON THE DEAL METEORITE.

BY F. J. KEELEY.

In the JOURNAL OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, 1830, Volume VI, page 182, Mr. Robert Vaux and Dr. Thos. M'Euen described the fall of a small stone meteorite at Deal, Monmouth County, New Jersey, August 14, 1829, 11.30 P. M., a portion of which they presented to the Academy.

In 1851, Shepard, who had received part of this specimen from the Curators of the Academy, published some further information, including a determination of its specific gravity, which he reported as 3.25 to 3.30.

At the present time, but thirty grams of this meteorite is known to be in existence, hence, sufficient material for adequate investigation is not available without too greatly impairing the specimens, but it seems desirable that at least some additional description be recorded.

The Academy's specimen, which weighs 20.8 grams, and therefore constitutes over two thirds of the known material, consists of one end of a stone that may have been originally three times as large. Its length is about 35 mm., width 25 mm. and thickness 15 mm. and on more than half of it, the original surface is preserved, rounded and pitted by fusion, and covered with a dull black crust averaging .3 mm. in thickness.

The broken surface, of about 30 mm. by 25 mm., when examined with the microscope, is extremely fine and uniformly grained and of pale pearl gray color, penetrated by a few narrow black veins which are continuous with the crust and branch and anastomose. Scattered through the mass are innumerable minute grains of metal and sulphide, the largest of the former not exceeding 1 mm. and few being over .2 mm., while the grains of sulphide average even smaller with no tendency to form larger nodules. There are also a few small black particles and a slight rusty tint is visible over much of the surface but no exudations of molysite to indicate the presence of lawrencite. A careful study of the entire broken surface under a binocular compound microscope with magnification of about 40, failed to reveal a single chondrule or larger crystalline mass, but near one end there is a spherical depression about 1.5 mm. in diameter which looks as if it might have been the matrix of a chondrule.

Unless this very slight character is accepted as sufficient, there is nothing visible on the specimen to justify classing it as a chondrite. On the broken face was a partly separated spall, a few millimeters in diameter, which was removed, and from it a rather unsatisfactory section prepared for microscopical examination. This section, which would have been entirely too small to represent the meteorite generally, had not the preliminary examination demonstrated a remarkable degree of uniformity throughout the stone, shows a fine granular texture made up of minute angular fragments of enstatite and olivine, mostly too small for satisfactory determination. There are two or three individuals in the section which exceed .5mm in length, but many less than .1 mm. A portion of one of the veins passes through the section. It is black and opaque, and about .02 mm. thick throughout most of its length, with several lenticular thickenings, which generally include grains of metal and sulphides. Numerous small grains of metal are likewise scattered among the silicates, together with even more plentiful, but smaller, grains of troilite or pyrrhotite. A few opaque black grains, with some indications of crystal faces, are probably chromite.

The most interesting feature exhibited by the section, is the presence of not inconsiderable quantities of a glassy transparent substance that may be identified as maskelynite, resembling in all respects that of Alfianello. This mineral, which has a refractive index so close to that of balsam that the ground surfaces appear as if perfectly polished, generally occupies irregular spaces between the magnesian silicates and sometimes holds small grains of the latter as inclusions, but in one case takes the form of a nearly circular grain suggesting a rounded crystal, with its interior clouded with numerous small inclusions. When examined in ordinary light under high powers, using good objectives and carefully adjusted illumination, there occasionally appear in it systems of fine parallel lamina, sometimes intersecting. On applying polarized light, such spaces generally show faint double refraction, somewhat similar to that of leucite. Not the comparatively strong double refraction of large leucite crystals, but more closely resembling that of the small crystals in fine grained Vesuvian lavas, which likewise sometimes show similar parallel laminations with ordinary light. These laminations might be interpreted as indicating incipient polysynthetic twinning in a feldspathic material, but the resemblance shown by all the characters of maskelynite to those of leucite, seems to furnish some justification for Groth's opinion that the two minerals are closely related.

MARINE MOLLUSKS OF HAWAII—XIV, XV.

BY HENRY A. PILSBRY.

Part of the Hawaiian tectibranch mollusks were considered in part II of this series.¹ Others were found in the Bryan and Thaanum collections, and in material taken in 1913. Probably further additions can be made when material collected this year is assorted; but as the following revision has already been held some time awaiting the preparation of illustrations, it is thought best to publish at this time.

Very little is known of the ecology of Hawaiian Tectibranchs. Collectors of living specimens should note their stations and such conditions as can be observed.

Little additional information has come to hand on the Aplysioid and Notaspidian Tectibranchs since the publication of Manual of Conchology, Vol. XVI, in which the known species are described.

Key to Hawaiian genera of cephalaspidian Tectibranchs.

1. Shell an open, flat spiral, wholly concealed, the mantle con-
cent over it *Aglaja* Ren.
Shell not covered by the mantle..... 2
2. Spire exposed..... 3
Spire deeply sunken or concealed..... 6
3. Spire more or less conic, the apex not depressed..... 4
Spire convex or level, apex not projecting above the following
whorl..... *Hydatinidæ*.
4. Larger shells, with a strong columellar fold or a basal truncation;
spiral grooves punctured when present..... 5
Smaller, white shells with a weak columellar fold and without
punctured spiral grooves; apical whorl tilted on edge.
Acteocina Gray.
5. Columella having a strong, bilobed fold above, concave below;
imperforate..... *Pupa* Bolt.
Columella straight, with a small fold above and obliquely truncate
at base; shell oval, with close spiral sculpture; perforate.
Bullina Fér.

¹ Proc. A. N. S. Phila., 1917, p. 214.

6. Summit narrowly, deeply umbilicate..... 7
 Summit imperforate or barely perforate..... 8
7. Shell larger, in large part smooth, marbled with brown.
Bullaria Raf.
 Shell small, spirally sculptured throughout, often banded.
Mnestia Ads.
8. Axial margin above the summit folded..... *Atys* Helbl.
 Axial margin not folded above..... 9
9. Columella abruptly truncate anteriorly..... *Dinia* Ads.
 Columella slightly concave, indistinctly truncate anteriorly;
 shell having incised spiral lines throughout.
Haminæa, subg. *Liloea*.
- Columella broadly, strongly concave, not truncate..... 10
10. A thin, broad, spiral plate posteriorly on columella; shell green,
 shaped like a split bean..... *Smaragdinella* Ad.
 No such columellar plate; light colored..... 11
11. Summit produced in a narrow spout; shell very fragile, showing
 the interior in a basal view..... *Volvatella* Pse.
 Summit not produced..... 12
12. Summit rather narrow, not impressed over the axis; aperture
 very ample below..... *Scaphander* Montf.
 Summit rounded, impressed in the center.. *Haminæa* T. & K.

ACTEONIDÆ.

Three species of the genus *Pupa* Bolt. (*Solidula* F. deW.) have been found. *P. nitidula* (Lam.), a widely dispersed species, is known from the Islands by specimens in the collection of the Academy from Dr. Newcomb. It has not been found by any recent collector, so far as I know. It seems possible that Newcomb's shells were from Polynesia. In his time many shells from the southern islands were coming into Honolulu in the missionary schooner *Morning Star*, and sold there for the benefit of missions.

1. Nearly white; smooth save for a group of spiral grooves at the base; spire very short, apex mamillar; columellar fold very heavy and prominent. Length 17, diameter 9 to 10 mm.
P. nitidula (Lam.)
 Spirally grooved at summit and below middle of last whorl, or throughout; spire conic..... 2
2. Deeply grooved spirally throughout; 9 x 4 to 11.5 x 5.1 mm.
P. thaanumi Pils.

Grooves narrower, less deep; obsolete or weaker and more widely spaced above the middle of last whorl; 13 to 14 mm. long. Fossil, around Pearl Harbor.....*P. pearlensis*, n. sp.

***Pupa thaanumi* Pils.**

Further specimens of this species confirm the characters of color and sculpture, but show that it sometimes reaches a larger size; and some specimens are broader with relatively shorter spire. Two from Haena, Kanai, measure:

Length 11.5, diameter 5.1 mm.

Length 10, diameter 4.7 mm.

Kauai: Haena. Oahu: Honolulu; Mokapu Point.

***Pupa pearlensis* n. sp. Figure 1.**

The shell is similar in shape to *P. thaanumi*. It differs by the larger size, the narrower, less deeply cut spiral grooves; above the middle of the last whorl several grooves are lacking in typical specimens; when present they are weaker and more widely spaced than in *thaanumi*. No color is visible in the fossil specimens.

Length 13.7, diameter 7.2 mm. Type. Near Waipahu.

Length 14, diameter 6.8 mm. Near Aiea Station.

Length 11.5, diameter 6 mm. Near Aiea Station. Young.

Oahu: fossil in superficial deposits along the Oahu Railway in the neighborhood of Pearl Harbor. The type lot is from the bank of a taro patch on the west side of the railroad about half a mile west of Waipahu Station. Also found east of Aiea Station, 6-10 feet above level of the Eastern Loch (Pilsbry), and at Hoaeae (W. A. Bryan).

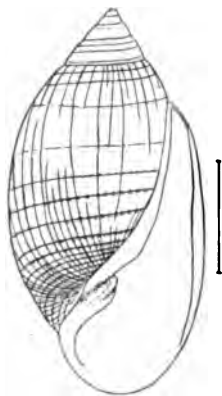


Fig. 1.—*Pupa pearlensis*, n. sp.

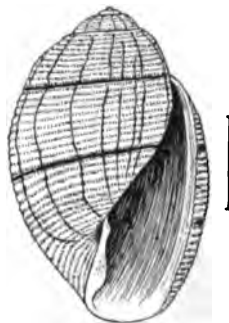


Fig. 2.—*Bullina scabra solida*, n. subsp

***Bullina scabra solida* n. subsp. Figure 2.**

Differing from *B. scabra* by its solidity, the lip being far thicker. The fold near the upper end of the straight columella is much stronger. It agrees with *B. scabra* in the sculpture of close, punctate, spiral furrows, and in the color, two red lines dividing three zones which have thin, waved axial red lines.

Length 12.3, diameter 7.7 mm.

Oahu: Honolulu, type locality; Kauai: Haena (Wm. A. Bryan).

The ordinary thin form of *B. scabra* I have not seen from the Islands. Even the young shells of the Hawaiian race are thick.

***Bullina vitrea* Pease.**

Bullina vitrea Pse., P. Z. J. 1860, p. 19; repeated in Man. Conch. XV, p. 177. Sowerby, Conch. Icon. XVIII, pl. I, fig. 4.

Described as thin, fragile, with or without one or two gray bands composed of two or three black lines, and with no axial lines. Otherwise appears rather similar to *B. scabra*. Not yet found by modern collectors.

ACTEOCINIDAE (Tornatinidae).³***Acteocina sandwicensis* (Pse.)**

Honolulu, Oahu; Haena, Kauai.

***Acteocina honoluluensis* Pils.**

Honolulu and Haleiwa, Oahu; Lisiansky I.

***Acteocina hawaensis* Pils.**

Off Maui, near Lahaina.

BULLARIIDAE.***Bullaria peaseana* (Pils.)**

Bulla peaseana Pils., Man. Conch. XV, p. 348.

This mottled species, very similar to the West Indian *B. occidentalis*, is generally spread in the islands. Specimens are before me from Oahu: Haleiwa, Kaneohe Bay, Kailua. Maui: Light-house Point, Lahaina. Hawaii: Hilo.

SCAPHANDRIDÆ.

Scaphander (*Bucconia*) *alatus* Dall, and *Scaphander* (*Sabatia*) *pustulosus* Dall, are from deep water, 234 to 298 fathoms, near the Hawaiian Islands.

***Smaragdinella viridis* (Q. & G.)**

Oval, thin, green, with a thin, broad plate on the columella. Koko Head, Oahu, collected by Wm. A. Bryan; taken also by earlier collectors in the Islands, but not definitely localized.

³For descriptions and figures of the three species enumerated, see Proc. A. N. S. Phila., 1917, pp. 215, 216; 1920, p. 300.

Dinia compitorum n. sp. Figure 3.

The shell is white, oblong, perforate, rounded below, truncate and imperforate at the summit. The surface has faint traces of spiral striae, and at the base there are several distinct spirals. The lip is inserted in the center above, rising but little; outer lip is quite

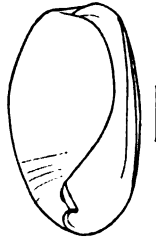


Fig. 3.—*Dinia compitorum* n. sp.

slightly curved, and in adults is rather strongly thickened within. In profile view it recedes decidedly above, very little at the base, and curves forward very slightly elsewhere. The columella projects obliquely towards the right and is abruptly truncate at base.

Length 7.1, diameter 4 mm.

Oahu: Honolulu, type locality and Haleiwa (Pilsbry, 1913); Paumalu and Mokapu Point (Bryan). Maui: off Mala Bay, near Lahaina in 25 to 75 feet. (Thaanum and Langford).

Dinia has been considered a subgenus of *Atys* but it differs by lacking a spiral fold in the lip ascending from the summit, and by the very strong truncation of the columella, characters sufficient for generic separation. There are now four Indo-Pacific species.

ATYS.

Five of the six species of *Atys* now known from the Islands were figured in the first paper of this series, 1917, pp. 216–218. A fossil (Pleistocene?) species, probably extinct, is now added.

Key to the Hawaiian species of *Atys*.

1. Columella rather thin, mainly vertical or weakly sigmoid, the edge but narrowly reflected (*Atys* proper).....2
Columella thicker, its edge reflected, bounded by an arcuate groove (Subgenus *Aliculastrum* Pils.).....3
2. Diameter about two-thirds of the length; rather inflated, often striped; 15.5 x 10 mm.....*A. kuhnei* Pils.
Smaller, less inflated, white.....*A. semistriata* Pse.

3. Apical part of the lip biangulate at summit; diameter slightly less than half the length.....4
Lip not biangulate at summit; diameter about half the length;
19 x 9.5 mm.....*A. kekele* n. sp.
4. Shell conspicuously widest below the middle...*A. debilis* Pse.
Shell widest about the middle.....5
5. Surface axially weakly plicate; 5 x 2.3 mm....*A. costulosa* Pse.
Without noticeable axial sculpture; 10.6 x 4.8 mm.
A. cornuta Pils.

***Alys semistriata* Pease.**

Proc. A. N. S. Phila., 1917, p. 217, fig. 5.

The specimen in the Pease collection which I figured is larger than any others seen, few of which exceed 10 mm. in length. Typically it is distinctly wider below the middle, but sometimes the greatest diameter is nearly median. There is also variation in the number of engraved lines on the lower third, which are often less numerous, perhaps always so in the immature shells. Specimens seen are from Kauai: Hanalei River and Haena. Oahu: Waikiki beach, Kahala and Waimanalu. Maui: Kahului dunes (Bryan). Kahoolawe (Pilsbry).

***Alys semistriata* mua n. subsp.**

The shell is decidedly compressed near the summit which is narrower than in the typical form.

Honolulu (Pilsbry, 1913). 116611 A. N. S. P.

***Alys semistriata* fordinsulæ n. subsp.**

Greatest diameter about median; about 10 spiral grooves above and below. Length 10.5, diameter 6.3 mm. Ford's Island, in Pearl Harbor (W. A. Bryan).

***Alys kekele* n. sp. Figure 4.**

The shell is oblong, widest below the middle, tapering slowly posteriorly to the rather narrow, angular vertex; outline towards the base rather strongly convex. Near the summit there are 8 or 9 spiral grooves, the lower ones widely spaced. The convex base has numerous finer and closer linear grooves. Vertex rather deeply excavated. The aperture is very narrow in the upper half, moderately dilated below. There is a strongly salient, compressed fold in the sloping upper margin of the lip. Columella rather thick, nearly straight, joining the basal margin in a short curve. Basal margin retreating.

Length 19, diameter 9.5 mm.

Length 17, diameter 8.5 mm.

Oahu: on a taro patch embankment west of the Oahu railroad, about a half mile west of Waipahu station, Pilsbry, 1913. Type 116610 A. N. S. P.

Only found fossil in earth dug out of the taro field probably Pleistocene. It is related to *A. cylindrica* (Helbl.), but in the present species the upper part of the aperture is narrower, the excavation of the summit deeper with angular margin; the base is more effuse, and the columellar callus is more raised, the groove bounding it being wider.



Fig. 4.—*Alys kekele*, n. sp.

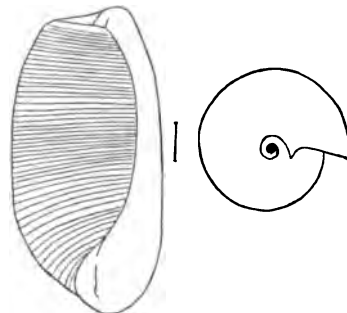


Fig. 5.—*Mnestia pusilla* (Pse.)

Mnestia pusilla (Pease). Figure 5.

Haminea pusilla Pse., P. Z. S. 1860, p. 20; description repeated in Man. Conch. XV, p. 364.

This species was described by Pease in his earlier manner, Linnean in brevity. It is not present in his collection in the M. C. Z., but his allusions to its small size, solidity, cancellated surface and umbilicate apex apply well to a small shell which has been taken in several localities.

The shell is solid, nearly cylindric in the middle, contracting rather abruptly towards the ends. It is whitish with an ill-defined white band near the base, some indistinct brownish markings above it. The surface has strongly impressed spiral lines throughout, the intervals cut by much finer, shallower, close axial impressed lines, hardly visible except under the microscope. The aperture is very narrow in the upper two-thirds, but dilated somewhat below. The outer lip rises well above the vertex, which is narrowly, deeply umbilicate; outer margin rather straightened. Columella nearly straight and having a very slight fold.

Length 5, diameter 2.4 mm., largest specimen.

Oahu: Honolulu, Mokapu Point and Paumalu (W. A. Bryan); Haleiwa (Pilsbry). Maui: off Kaanapali in 60 feet. (Thaanum and Langford).

This species is smaller than *Mnestia bizona* (A. Adams), and does not have the distinct bands of the typical form of that species; but the relationship appears to be very intimate.

The shore specimens are bleached quite white.

Mnestia has been generally considered a subgenus of *Cylichna*. Many authors consider the latter name to be a homonym of *Cylichnus* (Insecta), and moreover, *Mnestia* differs from *Cylichna* by its well developed spiral sculpture; its soft parts are unknown. For the present it appears best to treat the two groups as generically distinct.

AKERIDÆ.

HAMINÆA.

*Haminæa*³ appears divisible into three sections by the structure of the columella. These are defined in the following.

Key to Hawaiian species of *Haminæa*.

1. Columella deeply concave, the reflected columellar margin crescentic, rather thick, its edge separated from the whorl by a furrow. Section *Haloa*, new section, type *H. crocata* Pse. 2
- Columella but slightly concave, the columellar edge free, narrow, and but little reflected, an umbilical crevice behind it. Shell narrow (diameter less than half the length in our species); sculptured with engraved spiral lines throughout. Subgenus *Liloa*, new subg., type *H. tomaculum* Pils. 4
- Columella concave, its reflected margin rather broad, thin, at the edge closely appressed to the whorl. Section *Haminæa* proper, type *Bulla hydatis*; not known to be represented in the Hawaiian fauna.
2. Apex perforate. *H. sandwichensis* Sowb.
- Apex imperforate. 3
3. Oval; diameter two-thirds the length or less; yellowish when fresh; less than 14 mm. long. *H. crocata* Pse.
- *H. galba* Pse.

³ Iredale has shown that the earliest spelling of "*Haminea*" was *Haminæa*. Proc. Malac. Soc. Lond. XI, p. 172.

More globose; white; 14 to 17 mm. long. *H. aperta oahuensis* Pils.

4. Diameter equalling or close to half the length. *H. curta* (A. Ad.)
Diameter less than half the length..... 5
5. Nearly cylindric, elongate..... *H. tomaculum* Pils.
Shorter; sides distinctly convex..... *H. olopana*, n. sp.

***Haminea crocata* Pease. Figure 6.**

Oval, light ochraceous buff. The specimen figured, received from Pease, measures, length 13.2, diameter, 8.3 mm., but most of those seen are smaller. *H. crocata* is scarcely to be distinguished from *H. galba* Pse.; the latter (fig. 7, length 11, diameter 6.8 mm.) is perceptibly less swollen, with the lip rising less at the summit; according to Pease there are differences in the shape and color of

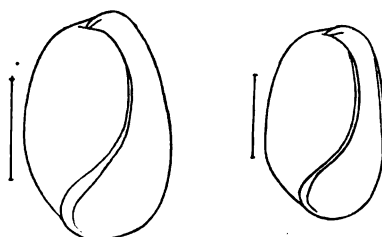


Fig. 6.—*H. crocata* Pse. Fig. 7.—*H. galba* Pse.

the living animals. In actual practice I find the assorting of specimens far from easy. The historic examples figured are extremes and recently collected shells often fall short of the ideal form. Both forms have a close, fine, shallow and wavy spiral striation, scarcely visible except under the microscope.

Probably when the living animals are observed the conclusions of Pease can be tested, and the matter put on a sounder basis.

H. crocata is before me from Paumalu, Kailua, Koko Head and Kaneohe Bay, Oahu, and Haena, Kauai. Specimens referable to *H. galba* from Paumalu, Honolulu, Kaneohe Bay, Oahu, and Haena, Kauai.

***Haminea sandwichensis* Sowerby.**

This shell is said to have an umbilicated summit and more pointed ends. It is white, and rather similar to the preceding in shape. I have not seen it in some hundreds of Hawaiian *Hamineas* examined.

***Haminæa aperta oahuensis* Pils.**

Oahu: $1\frac{1}{2}$ miles east of Kahuku, Pilsbry. Additional specimens from Oahu are somewhat larger, up to 17 mm. long. They are strongly malleate or faceted around the middle.

In the section *Haloa*, containing the foregoing species, the columella resembles that of *Bullaria* or *Aliculastrum*.

***Haminæa curta* (A. Ad.) Figure 8a.**

Bulla curta A. Adams, Thesaurus Conchyliorum II, p. 582, pl. 124, fig. 100. Pilsbry, Man. Conch. XV, p. 368.

This species was described without locality. Specimens from Fiji collected by Andrew Garrett agree with the original figure. I refer to this species provisionally two smaller, perhaps immature, examples from Kaneohe Bay, Oahu, one of them figured. It measures, length 7, diameter 3.5 mm. The straighter lateral outlines separate this from *H. olopana*. It has the same sculpture as *H. olopana*, fine, clearly engraved spiral lines of which I count about 36.

H. curta was first reported from the Sandwich Islands by von Martens.⁴ Cooke united as synonyms certain Red Sea forms, whether correctly or not remains to be seen.

The original figure of *H. curta* measures, length 14.3, diameter 7.5 mm. One from Fiji measures, 12.3, diameter 6.3 mm. The summit is very minutely perforate, and the lateral outlines are a trifle straighter than in the Kaneohe Bay form figured.

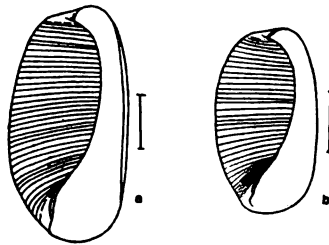


Fig. 8.—a, *Haminæa curta* A. Ad. b, *H. olopana* n. sp.

***Haminæa olopana* n. sp. Figure 8b.**

The shell approaches a cylindric form, but the outlines are noticeably convex. It is thin, translucent whitish with opaque white terminations. Surface scored by fine spiral lines of which I count 26 just behind the outer lip. There are additional closer ones in

⁴ Donum Bismarckianum, p. 53.

the columellar-basal region. These impressed lines are very smoothly evenly engraved, widely spaced, and appear white on the translucent ground. The rounded vertex is minutely perforate. There is a fine slit behind the columellar callus. The aperture dilates below. Outer lip arches forward; basal lip receding. The columella is only weakly concave with a narrow, expanded edge, forming a long umbilical crevice; below it is slightly truncate.

Length 7.8, diameter 3.3 mm.

Kauai: Haena (W. A. Bryan).

A less cylindric species than *H. curta*.

***Haminea tomaculum* Pils.**

Haminea curta tomaculum Pils., Proc. A. N. S. Phila., 1917, p. 219, fig. 10.

Further study of the Hawaiian *Hamineas* convinces me that this form differs specifically from *H. curta* A. Ad.

The three species preceding, as well as *H. papyrus* (A. Ad.), *H. brevis* (Q. & G.), *H. cairnsiana* Melv. and *H. cuticulifera* Smith, belong to the group which I have called *Liloea*. It is quite possible that when the animal can be examined, this group will be transferred to the vicinity of *Atys*. The sculpture and the form of the columella are much like *Atys* and unlike other groups of *Haminea*. *Atys*, however, has a fold in the axis posteriorly. *Roxaniella* Monts and *Damoniella* Iredale¹ differ by having the summit umbilicate. It is barely perforate or sometimes imperforate in *Liloea*.

***Volvatella fragilis* Pease.**

Volvatella fragilis Pease., P. Z. S. 1860, p. 20; Amer. Journ. Conch. IV, p. 73, pl. 7, fig. 4. Description and figures repeated in Man. Conch. XV, p. 384.

Sandwich Islands. Not found since the time of Pease.

HYDATINIDÆ.

Thin, oval, capacious shells, banded, with the spire flattened or convex. The Hawaiian species are widely ranging forms.

1. Base contracted by a furrow running spirally from the insertion of the columella; aperture shorter than the shell; two pink and three white zones, separated by narrow blackish bands.

Hydatina (Aplustrum) amplustre (L.).

Base not so contracted; aperture nearly as long as the shell; columella broadly concave.....2

¹ *Damoniella* Iredale, Proc. Malac. Soc. Lond. XIII, p. 37, new name for *Roxania* Leach, not *Roxana* Stephens. Type *Bulla cranchii*.

2. Large, with many brown spiral lines; columellar reflection lunate, not appressed; spire level, of $3\frac{1}{2}$ whorls parted by a deep suture; length 26, diameter 18 mm.

Hydatina physis staminea (Mke.)

Small, with two or three remote spiral lines and spaced, festooned axial lines of brown; spire minute, of $2\frac{1}{2}$ whorls; columellar reflection closely appressed; length 9, diameter 6 mm., often smaller.....*Micromelo guamensis* (Q. & G.)

Hydatina physis staminea (Mke.)

Honolulu Harbor, Oahu; Kainalu, Molokai (Wm. A. Bryan).

All of the Hawaiian specimens seen belong to this subspecies. The typical *H. physis* is larger and more globose.

Hydatina (Aplustrum) amplustre (L.)

Honolulu Harbor and Kahana, Oahu; Kailua, Hawaii (W. A. Bryan). Kahoolawe (Pilsbry).

Easily recognized by the pink and white zones bordered with wide blackish lines. One from Kahoolawe measures, length 21, diameter 15 mm.

Micromelo guamensis (Quoy & Gaimard). Figure 9.

Hawaii: Kailua (Wm. A. Bryan). Hilo (Garrett, for *Bulla scripta*).

This snail appears to have been collected rarely, though described long ago. Besides the peculiarities of shape and color-pattern shown in the figure it has spaced spiral series of oblong punctures, *Acteon* like, not easily seen without a lens. The narrow spire is level. The specimen figured measures: length 9, diameter 6 mm. Others are smaller.

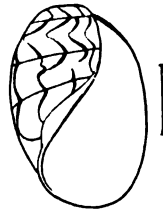


Fig. 9.—*Micromelo guamensis*.

AGLAJIDÆ.

Aglaja, better known as *Doridium*, appears to be well represented in the islands, though so far as I know, each species has been taken but once. Two were described by Pease under the genus *Philinopsis*, which appears to be the same as *Aglaja*.

The small shell is entirely concealed in the mantle.

Aglaja speciosa (Pease)

Above fawn, spotted and speckled with white, margins varied with blackish and yellow; sides paler; foot purplish fawn closely freckled with whitish. 3 inches long.

Seen only by Pease, whose full description of this species and *A. nigra* may be found in Manual of Conchology, vol. XVI. He gave only "Sandwich Islands" as locality.

***Aglaja nuttalli* Pils.**

Uniform black-brown above, pale with faint lighter maculation below. A caudal filament. Length 40 mm.

Sandwich Islands (Nuttall). Based on an old alcoholic specimen. Man. Conch. XVI, p. 50.

***Aglaja nigra* (Pease)**

Black, two large white spots on anterior end, two on head disc, and two on mantle lobes; sides white. Foot white, with three large black spots on each revolute side. Unknown to recent collectors.

***Aglaja pilsbryi hawaiiensis* n. subsp. Figure 10.**

Similar to *A. pilsbryi* Eliot,* of the Samoan Islands, in having figure 8 shaped black marks on both cephalic shield and mantle, but the figures are heavier than in that species. The markings on the parapodia are reduced to a few black spots along the lateral borders, four on each side, one being beneath; and there is an imperfect black rim on the front edge of foot. The ground color is brownish (perhaps stained by the alcohol, which has a yellowish tint). No posterior filament.



Fig. 10.—*Aglaja pilsbryi hawaiiensis*.

Length about 24 mm.

Hilo, Hawaii (D. Thaanum). Type 47421 A. N. S. P.

This is probably related to *A. nigra* (Pse.), and may possibly be a less pigmented form or race of that, though I do not think so. As Pease's species has not been figured, no close comparison can be made.

XV. VARIOUS GASTROPODS AND PELECYPODS.

MURICIDÆ.

***Vexilla thaanumi* n. sp.**

Hilo, Hawaii. Types no. 127747 A. N. S. P., collected by D. Thaanum.

The shell is obovate, widest at the upper third, very solid. Surface dull, regularly sculptured with very low, rounded, cantiguous

* *Doridium (Aglaja) pilsbryi*, Eliot. Proc. A. N. S. Phila., 1899, p. 512, pl. 19, figs. 1a, 1b. Reef at Apia, Samoan Is. The type specimen is No. 47422, A. N. S. P.

spiral girdles parted by impressed lines, and themselves weakly striate spirally; deep brownish drab, every third or fourth girdle yellowish, or in worn shells whitish; there being 8 or 10 of these pale, narrow bands. The spire is extremely short and obtuse. The aperture is oblique, of about equal width almost throughout, blackish brown deep in the throat, becoming pale or white within the lip. The outer lip is very thick, bevelled, liver-brown, its outer edge minutely scalloped, the inner edge set with 10 or 12 small teeth. The columellar border is broadly flattened, vinaceous-brown with pale inner edge.

Length 14, diameter 9.5 mm.; length of aperture 12.3 mm.

Length 13.6, diameter 9.6 mm.

The operculum is liver-brown, long and narrow, widest above, the nucleus (which is worn away) at the upper, outer extremity; the outer margin arcuate, inner margin straight.

It is near *V. taeniata* Powys, but smaller and wider in the upper part.

Murex cyclostoma baldwiniana n. subsp.

The shell is similar to *M. cyclostoma* Sowb. in having the faces of the varices cellular, in the shortly oval aperture and sculpture of strong encircling cords; but the specimens from two sources are very much smaller. There are 5 cords on the last, 2 on the penult whorl. The nearly closed anterior canal is a little shorter than the aperture.

Length 8.2, diameter 5.2 mm.

Kailua, Kona coast of Hawaii (Bryan); Maui (D. D. Baldwin).

Possibly distinct from *M. cyclostoma*, which is a much larger shell; a longer series is needed to show whether the small size is constant.

VANIKORO.

The following species of *Vanikoro* are now known from the Islands. For references see Smith, Proc. Malac. Soc. London, VIII, 104-117.

Vanikoro semiplicata Pease. Hilo, Hawaii; Paumalu, Oahu; Haena, Kauai.

Vanikoro imbricata Pease. Hilo, Hawaii; Kaneohe Bay, Oahu.

Vanikoro acuta (Recl.). Kaneohe Bay, Oahu; Haena, Kauai. Originally described from Lord Hood's Island, on coral reefs. The Hawaiian specimens appear to be quite typical.

Vanikoro hawaiiensis n. sp.

The shell is openly umbilicate, subglobose, with small, conic, acute spire; white with the apex brown. Embryonic and nepionic 3

whorls brown, high conic, the first smooth, the others having 3 spiral cords. The next two whorls have very strong retractive ribs nearly as wide as their intervals, crossed by spiral cords which bead the ribs. On the first post-nepionic whorl I count 13 ribs; on the second there are about 9 cords, and the ribs become very low, fading out, on its last third. The last $1\frac{1}{2}$ whorls have a close sculpture of slightly unequal spiral threads; lines of growth are scarcely visible. The umbilicus is funnel-shaped, rather weakly axially plicate within, its margin smooth and rounded. The aperture is oblique, semi-circular, the inner border slightly concave.

Length 5.5, diameter 5.4 mm., $3\frac{1}{2}$ post-nepionic whorls.

Hilo, Hawaii; Kaneohe Bay, Oahu; Haena, Kauai.

Type 116963 A. N. S. P.

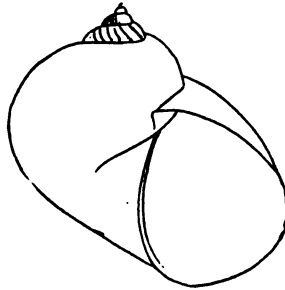


Fig. 10—*Vanikoro hawaiiensis*.

***Vanikoro kanakorum* n. sp.**

Shell openly umbilicate, subglobose, with a short, conic spire and slightly obtuse apex; white, the apex brown. The embryonic and nepionic shell is semiglobose, of little more than one whorl, and smooth. Retractive ribs then set in, continuing for two whorls; their intervals are a little wider than the ribs, and crossed by about 10 spiral cords. The adult sculpture abruptly replaces this ribbed neanic stage. It consists of spiral threads, between which there are one to three finer threads. Lines of growth are scarcely noticeable. The umbilicus is funnel-shaped, slightly plicate inside, bounded by a nearly smooth rib, but slightly prominent. The aperture is semi-circular.

Length 3.7, diameter 4 mm.; $3\frac{1}{4}$ post-nepionic whorls.

Haena, Kauai.

The shape of the shell, in the floating stage, differs entirely from that of *V. hawaiiensis*. The ribbed neanic stage is longer. The type

would probably add another whorl; I think it is possibly not full-grown; but I cannot identify it with any of the species hitherto described.

CÆCIDÆ.

In the Challenger Report, de Folin records *C. sepimentum* de Fol., *C. crystallinum* de Fol., and *Strebloceras subannulatum* de Fol. from Honolulu. Subsequently he added *Meioceras sandwichensis* de Fol.

C. sepimentum has been taken at Hilo, Hawaii, by Thaanum, abundantly at Mokapu Point, Oahu, by Bryan, and at Moomomi, Molokai by myself. *S. subannulatum* also occurs at Mokapu Point.

Cæcum oahuense n. sp.

The shell is similar to *C. sepimentum* in form. It has an evenly convex septum. The aperture is moderately contracted. Sculpture of 40 rounded rings, hardly as wide as their intervals, and much smaller than those of *C. sepimentum*.

Length 2.2, diameter at septum 0.38, at aperture 0.5 mm.

Mokapu Point, Oahu.

Fossarus ecphora n. sp.

The shell is umbilicate, white with a dark brown embryonic whorl. Sculpture of three very prominent spiral ridges and one or two minor ones on the last whorl, the upper one appearing on earlier whorls, the rest of the surface having fine spiral threads and axial striae. Spire shorter and ridges stronger than in *F. lamellosus* Montr.

Altitude 2.3, diameter 2.5 mm.

Haleiwa, Oahu, Pilsbry, 1913.

This is evidently not the young of *F. garrettii* Pse., which has been taken at Hilo, Hawaii and Koko Head, Oahu.

F. multicostata Pse., has been found at Waikiki and Kaneohe Bay, Oahu.

Epitonium decussatum (Pease).

Not an uncommon species. Dr. Dall informs me that the name is pre-occupied.

Epitonium kanemoe n. sp. Fig. 11 b.

It is very slender, imperforate, white, with sculpture of slender, recurved ribs, 8 on the last whorl, the intervals having minute axial striae and coarser, more spaced spiral threads. Whorls not quite in contact except at the ribs.

Length 10.4, diameter 3.3 mm.; 10 whorls, the tip lost.

Haena, Kauai.

It is as narrow as *E. umbilicatum* (Pse.), but has fewer ribs and the spirals would not be called "remote." It is more slender than *E. decussatum*, with more delicate ribs.

***Epitonium fucatum* (Pse.) Fig. 11 a.**

It is broader, than *Epitonium decussatum*, clouded with brown in the peripheral region, with rather strong ribs, 10 on the last whorl. Interstitial sculpture and form of the whorls about as in *decussatum*. Honolulu Harbor.

Length 14.5, diameter 5.8 mm.; 7 whorls remaining, the apex lost.



Fig. 11.—a, *Epitonium fucatum* b, *E. kanemoe*. c, *E. ulu*. f, *E. oahuense*.

Dr. Dall suggests that this may be the unfigured *Scalaria fucata* Pse.

***Epitonium ulu* n. sp. Fig. 11c.**

Related to *S. crispata* Pse., of the Paumotu group, but having the delicate riblets much more widely spaced. There are about 21 of these thread-like riblets on the last whorl. The base is perforate; columellar lip reflected below. Aperture rather trapezoidal, the parietal callus thin, outer lip narrowly reflected. White.

Length 14, diameter 5.8 mm.; 10 whorls, the tip lost.

Hilo, Hawaii. D. Thaanum.

***Epitonium oahuense* n. sp. Fig. 11d.**

Resembling *E. turricula* (Sowb.). The shell is umbilicate, rather thin, suffused and clouded with brown. Glossy, having thin riblets with a few wider ones, 14 on the last whorl; in the intervals minute, unequal engraved spiral lines may be seen. The whorls are in contact, well rounded. The aperture is shortly ovate, peristome adnate for a short distance above.

Length 14, diameter 5.3 mm.; aperture 3.5 mm. long; 9 whorls, the tip lost.

Oahu: Honolulu Harbor and Kahana.

Epitonium perplexum (Pse.) is the largest Hawaiian species known to me, also the most generally distributed. *E. alatum* (Sowb.), *E. millecostatum* (Pse.) and *E. decussatum* (Pse.) have been taken by Prof. Bryan and Mr. Thaanum. *E. attenuatum* and *umbilicatum* of Pease I have not seen. I have provisionally identified a small specimen from Waimanalo, Oahu, as *E. paumotense* (Pse.). The curious, solute *E. hyalinum* (Sowb.) is represented in Kaneohe Bay by specimens agreeing well with those from Luzon in shape, but of smaller size, the largest 8 mm. long, 4 wide, of five whorls after the slender nepionic tip; 8 ribs on the last whorl, 7 points on each rib. This small race may be called *E. hyalinum mokuoloense*.

Haplocochlias (Lophocochlias) minutissimus n. sp.

The very small shell is umbilicate, turbinate, not nacreous, white with a conic brownish spire. The first whorl appears to be smooth; on the second fine radial folds or puckering appears below the suture, becoming coarser on the following whorl. The last whorl has six strong, smooth spiral keels, narrower than the intervals, which are flat and crossed by numerous retractorily axial threads, which are much narrower than their intervals. Within the umbilicus two rather small spiral cords are seen. The aperture is quite oblique, subcircular. The outer lip is strengthened by a rounded external rib or varix a short distance behind the edge.

Length 1, diameter 0.9 mm.; 4 $\frac{1}{8}$ whorls.

Mokapu Point, Oahu, 4 specimens.

By the well-developed varix this shell resembles *Haplocochlias* or *Liotia*. I have placed it in the former genus with doubt. It differs by the very strong sculpture and the open though not wide umbilicus, which may characterize a separate section *Lophocochlias*.

This is the smallest Hawaiian sea shell I have seen.

LEPTOTHYRA.⁷

The following species have been reported from the Hawaiian Islands.

L. verruca Gld.

⁷Perhaps this name should yield place to *Anadema* A. Ad., but the type of that group is imperfectly known. It is larger than the known *Leptothyra*s. See *Man. of Conch.* X, p. 255.

L. rubricincta Migh.

L. candida Pse.

L. (?) marmorea 'Pse' Sowb.

L. costata Pse.

Only the first two can be considered well known.

Leptothyra verruca manti, n. subsp., differs from the typical form by the black (on the beach fading to brown or olive-brown) color of the tessellation, or it may be black with whitish spots, and the smaller size, altitude 4, diameter 3.8 mm. It is from Diamond Head, Oahu, Haena, Kauai and other places, often abundant.



Fig. 12.—*Leptothyra candida*
percostata.

Fig. 13.—*L. viaria*.

Fig. 14.—*L. balnearii*.

Leptothyra candida percostata (fig. 12) is a small, thick, white, narrowly umbilicate shell, with sculpture of 7 spiral ribs, the first radially plicate, the rest smooth, below them a broad, radially plicate border about the umbilicus. The aperture is rounded, oblique. Columella arcuate, narrow next to the umbilicus, very broad and flat at the base. Length 2.3, diameter 2.5 mm. It differs from *L. candida* as defined by Pease by the solidity and coarse ribs. Has been taken at Haleiwa and Honolulu (Pilsbry) and Hilo (Thaannum).

There are sometimes interstitial threads between the ribs.

Leptothyra balnearii n. sp. Fig. 14

The shell is perforate, solid and thick, red tessellated with white (or entirely red), the first whorl white. Sculpture of smooth spiral cords, of which four in the flattened peripheral region are large; above them there is a small cord and a flattened, radially plicate sub-sutural band; below there are four small cords and a strongly plicate band around the umbilicus. Aperture oblique. Columella

straightened outwardly, concave within, dilated and very broad towards the base. Outer lip thin-edged.

Altitude 2.6, diameter 2.6 mm.

Off Waikiki, 25-50 fms. D. B. Langford. This species agrees partly with Pease's *L. costata* (Maui), but that is said to be "mottled and spotted with white, black and brown." It is also larger.

Leptothyra viaria n. sp. Fig. 13.

The shell is solid, narrowly umbilicate, buff-white with small scattered olivaceous dots. Sculpture of about 5 smooth larger cords in the peripheral region, about 4 smaller ones on the base, the intervals of all finely striate spirally; above the peripheral cords there are subequal spiral threads, 7 in the type specimen; the penult whorl is angulated in the middle. Umbilicus is surrounded by a rounded, radially plicate ridge. The columella is narrow above, very much produced basally, with a broad, excavated face. Outer lip thin.

Altitude 3.7, diameter 3.5 mm.

Honolulu, type locality, and Haleiwa, Pilsbry,

Apparently related to *L. costata* Pse., but differing in proportions and various other details from that still unfigured species.

Siphonaria normalis Gld.

Specimens from numerous places on all of the islands except Lanai and Niihau examined, often in large series. There are many local forms, but so far as I can see, but one species, *S. normalis* Gld., which varies extraordinarily in size, color and sculpture. The following names are on the Hawaiian list.

S. normalis Gld. Proc. Bost. Soc. N. H. 11, 1846, p. 178; Otia Conch. pp. 12, 242; U. S. Expl. Exped., Mollusca, p. 359, pl. 30, fig. 468.

The type was a small, dark subregular form, 10 mm. long.

S. amara Nuttall, Reeve, Conch Icon., IX, 1856, pl. 7, fig. 33 ("California").

Said by Reeve to be from California, but this was a mistake. A set given by Nuttall is labelled "Atooi" (=Kauai). Carpenter has noted this in his Mollusca of Western North America.

S. funiculata Reeve, Conch. Icon. IX, pl. 7, fig. 35 (Hab. unknown). Name changed to *S. lirata* on index page, as *funiculata* had been used for another species.

This is the very black form.

S. nuttalli Hanley, Proc. Zool. Soc. Lond., 1858, p. 152 (Ins. Sandwich).

S. crebricostata Nuttall Ms. was placed by Reeve in the synonymy of *S. sipho* Sowb., but it was really a Hawaiian shell, a rather large form of *S. normalis*.

The specimens of a colony are usually rather uniform. The finest seen are from Lahaina, length 21, height 9 mm. In Honaunau Bay, Hawaii, all seen are small, about length 10, altitude 4.5 mm., and they are very black (var. *lirata* Rve.). Further up the coast the shells are larger, often with some ribs emphasized. At Moomomi, Molokai, the cavity is some shade of chestnut, border wide, whitish with many brown rays. Similar shells occur at Honokowai, Maui, Diamond Head, etc. These shells agree best with var. *amara*.

On the north shore of Kahoolawe I found some very flat shells with 4 or 5 posterior ribs very emphatic (fig. 15). This may be called *S. normalis* form *chirura*. Length 10.5, alt. 2.5 mm.

All of these forms have the same dark, oblong, *Nacella*-like embryonic shell, with posterior apex, and all seem to fade into one another in color and sculpture, in the series of some hundreds examined.

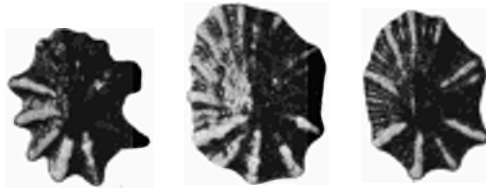


Fig. 15.—*Siphonaria normalis* form *chirura*.

***Stomatella concinna inconcinna* n. subsp.**

Similar to *S. concinna* in shape, but dull, greenish white, with some opaque white flames and sometimes a few small brownish dots on the base; these markings confined to the spiral cords. Spiral cords more or less distinctly alternating in size.

Greatest dimension 3.5 mm.

Honolulu, on the reef, Pilsbry, 1913. 3 specimens.

***Heteroglypta kanaka* n. sp. Fig. 16.**

The shell is oblong, compressed, white, faintly freckled with tawny. The small beaks are central. Anterior part tapering, rounded at the end. Posterior part wider, obliquely truncate. Sculpture of rounded ribs posteriorly, divaricating from a line from the beaks to the lower posterior angle, curved and running to the posterior end behind, straight and running to the basal margin in front of the line of divarication. The rest of the surface has narrow impressed lines running obliquely backward and downward except close to the anterior end, where there is some very weak oblique corrugation,

running to the upper anterior margin. The pallial sinus is deep, extending past the beaks. The right valve has two diverging cardinal teeth, and a pink spot on the hinge margin on each side of the cardinal region.

Length 11.4, altitude 6.3, diameter 3 mm.



Fig. 16.—*Heteroglypta kanaka* n. sp.

Off Waikiki, near Honolulu, 35–50 fms. D. B. Langford.

While it differs from *H. contrarius* Dh. in proportions of the shell and arrangement of the sculpture-areas, I have not found any more closely related species.

Loripes (*Pillucina*) *spaldingi* n. sp. Fig. 17.

The shell is rather strong, rounded-oval, higher than long, very plump; white with some unevenly spaced grayish streaks along darker lines of growth-arrest. Sculpture of rather irregular but close concentric wrinkles and radial lines, which are distinct at the ends but nearly obsolete in the median part. Beaks rather prominent, median. Anterior end evenly rounded; posterior end less produced and less convex; basal margin strongly convex. Lunule small, rather deeply impressed, wider and deeper in the right valve. The internal margin is finely crenulate. Cavity of the beaks narrow and deep. There is a stout median cardinal tooth in the right valve, a prominent,

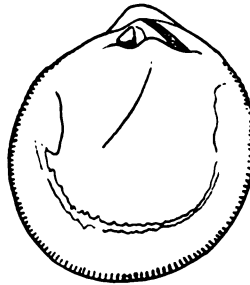


Fig. 17.—*Loripes spaldingi*, n. sp.

erect, triangular anterior cardinal in the left. No laterals. Anterior adductor scar elongate (shown too short in the figure).

Length 7.4, altitude 8.5, diameter 6.5 mm.

Oahu: Kaneohe Bay, Spalding, Thurston and Pilsbry, type locality; Paumalu, W. A. Bryan.

This little clam is related to the Japanese *Lucina parvula* Gld. (*L. pisidium* Dkr.), but it is plumper and higher. Lateral teeth seem to be entirely wanting. These species appear to represent a new subgenus of *Loripes*, *Pillucina*; *L. spaldingi* being the type. Shell plump, with radial sculpture, the anterior adductor scar less elongate.

Loripes is here used as defined by Dall, Proc. U. S. N. Mus. XXIII, p. 803.

DECEMBER 21.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Fifty-seven persons present.

Officers, Councillors, and members of the Committee on Accounts were elected for the ensuing year, as follows:

PRESIDENT..... John Cadwalader, A.M., LL.D.

VICE-PRESIDENTS..... Edwin G. Conklin, Ph.D.,
Henry Skinner, M.D.

RECORDING SECRETARY..... James A. G. Rehn.

CORRESPONDING SECRETARY..... J. Percy Moore, Ph.D.

TREASURER..... George Vaux, Jr.

LIBRARIAN..... Edward J. Nolan, M.D., Sc.D.

CURATORS..... Witmer Stone, A.M., Sc.D.,
Henry A. Pilsbry, Sc.D.,
Henry Tucker, M.D.,
Spencer Trotter, M.D.

COUNCILLORS TO SERVE THREE

YEARS..... Charles B. Penrose, M.D.,
Charles Morris,
William E. Hughes, M.D.,
Roswell C. Williams.

COMMITTEE ON ACCOUNTS..... Charles Morris.,
Samuel N. Rhoads.,
John G. Rothermel.,
Thomas Stewart, M.D.,
Walter Horstmann.

On the election of his successor as Recording Secretary in pursuance to a resolution adopted at the meeting in November, Dr. Edward J. Nolan, became Recording Secretary Emeritus for life.

Annual Reports were received from the Recording Secretary, the Corresponding Secretary, the Librarian, the Curators, the Treasurer, the auditors of the Treasurer's accounts, the Treasurer of the *Manual of Conchology*, the Curator of the William S. Vaux Collections, and from the following sections of the Academy: Biological and Microscopical, Entomological, Botanical, Ornithological, Mineralogical and Geological.

The Publication Committee reported the receipt of the following papers for publication:

“Additional Notes on the Deal Meteorite,” by F. J. Keeley.

“Description of a New Cyprinoid Fish (*Notropis stonei*), with Notes on other Fishes obtained in the United States,” by Henry W. Fowler.

The deaths of Theodore C. Search, May 10, 1920, and Alfonso de Figaniere, members, were announced.

The following was ordered to be printed:

**DESCRIPTION OF A NEW CYPRINOID FISH (NOTROPIS STONEI) WITH
NOTES ON OTHER FISHES OBTAINED IN THE UNITED STATES.**

BY HENRY W. FOWLER.

Several small collections of fishes obtained in various parts of the United States have been received at the Academy recently. A summary is presented herewith of those not reported previously, mainly as short annotated lists. One species obtained in South Carolina is described as new, and several others are recorded within new faunal regions or at new localities.

NEW JERSEY.

Mr. Henry S. Drinker has contributed interesting data on various sharks secured at Beach Haven. Dr. R. O. Van Deusen visited Blackwood in late April, 1920, and Tuckahoe, in Cape May County, on May 23, 1920. On September 12, 1920, the writer with Mr. Edwin Fowler, visited Laurie's Pond at Lakeside, near Yardville, in Mercer County. Mr. Wm. T. Innes visited Corson's Inlet on October 17, 1920, and sent a few notes on several common species seen there.

Carcharias taurus Rafinesque. Jaws of a small example, about 3 feet long, obtained at Brigantine during the past summer.

Carcharodon carcharias (Linné). Mr. Drinker reports a large example taken in a pound at Beach Haven, in early July, 1920. A small section of its skin, together with some copepods with which it was infested, were received later. As the specimen was largely butchered, Mr. Drinker had no opportunity to secure measurements or other data. This ferocious shark is only known in New Jersey waters from two previous records. The first notice is by Hussakof, who mentions seeing two teeth of a freshly caught specimen, alleged from the New Jersey coast, in early June of 1916. He estimated this specimen at 7 or 8 feet in length. Nichols reports the second example from off South Amboy, July 14, 1916, which he saw mounted, and measured $7\frac{1}{2}$ feet in length. These records appear to have been the only ones in 1916 suggesting that the shark scare of that season may have been due in part to the presence of the great white shark. Our record shows that the species occurs casually. It may be present more frequently than is generally supposed.

Eulamia milberti (Müller and Henle). Mr. Drinker secured one August 8, 1919, 8 feet, 6 inches in length, which weighed 300 lbs. Another caught August 5, 1920, was 8 feet, 7 inches long, girth at gills 45 inches, and weight 300 lbs. These were captured at Beach Haven, as well as two smaller examples, without detailed data, but which show the teeth slightly more serrate, or the serræ coarser. Jaws from an example secured recently at St. Thomas, West Indies, by Mr. N. P. Alexander, agree in every respect.

Hypoprion brevirostris Poey. Mr. Drinker secured a fine example of this species at Beach Haven, on July 11, 1919. It measured 9 feet 6 inches in length and weighed 265 lbs. The jaws have been received at the Academy. This is the first record, so far as I know, of the occurrence of the short-nosed shark in New Jersey waters, or north of the Carolinas. It is therefore another interesting addition to our local fauna.

Sphyrna zygaena (Linné). Mr. L. Hoffman reported two examples, each about 7 feet in length, at Beach Haven, on September 11, 1920. Other species also seen by him at this locality were: *Mustelus canis*; egg-case of large skate, containing embryo (probably *Raja ocellata*), *Pomatomus saltatrix*, *Roccus lineatus*, *Cynoscion regalis*, *Sciaenops ocellatus*, *Micropogon undulatus*, *Leiostomus xanthurus*, *Menticirrhus saxatilis*, *Pogonias cromis*.

Pomolobus pseudoharengus (Wilson). Blackwood.

Ameiurus natalis (Le Sueur). Blackwood and Tuckahoe.

Ameiurus nebulosus (Le Sueur). Lakeside.

Semotilus bullaris (Rafinesque). Blackwood.

Abramis crysoleucas (Mitchell). Tuckahoe.

Catostomus commersonnii (Lacépède). Blackwood and Tuckahoe, also the next.

Erimyzon sucetta oblongus (Mitchill).

Anguilla rostrata (Le Sueur). Tuckahoe and Lakeside, also the next.

Esox americanus (Gmelin).

Esox tridecemlineatus Mitchill. Blackwood and Tuckahoe.

Umbra pygmaea (De Kay). Lakeside.

Fundulus majalis (Walbaum). Corson's Inlet, with the next two.

Fundulus heterocheilus macrolepidotus (Walbaum).

Cyprinodon variegatus Lacépède.

Euleptorhamphus brevoortii Gill. The head of an adult example, now in the Academy, was secured by Dr Witmer Stone. It was given to him by a collector, Mr. Cunningham, who picked it up on

the beach at Cape May several years ago. But a single previous New Jersey record is known, and that is still represented by the example in the Academy obtained at Atlantic City in 1870 and reported by Cope. The species is rare on the coast of the United States.

Menidia menidia notata (Mitchill). Corson's Inlet, with the next.
Trachinotus carolinus (Linné).

Seserinus paru (Linné). Dr. Van Deusen sent a fine example, received from Fortescue, on Delaware Bay, July 13. He also reports 40 examples taken at Atlantic City at the same time. These are the first definite records we have for this species in New Jersey, as Abbott only refers to it in 1868 as *Peprilus longimanus* and vaguely from "our coast."

Pomoxis sparoides (Lacépède). Blackwood.

Acantharchus pomotis (Baird). Tuckahoe, with the next two.

Enneacanthus gloriosus (Holbrook).

Mesogomstius chætodon (Baird).

Lepomis auritus (Linné). Blackwood, with the next.

Lepomis incisor Valenciennes.

Pomotis gibbosus (Linné). Blackwood and Lakeside.

Micropterus salmoides (Lacépède). Blackwood, with the next.

Perca flavescens (Mitchill).

Boleosoma nigrum olmstedii (Storer). Tuckahoe and Lakeside.

Orthopristis chrysopterus (Linné). Two at Ocean City, July 30 by Prof. C. La Wall and one at same place, September 17, by Mr. D. McCadden.

Tautoga onitis (Linné). Corson's Inlet.

PENNSYLVANIA.

Several collections were made by the writer with Dr. R. O. Van Deusen and Mr. Frederick Morrell, July 5, 1920, in Montgomery County: Mine Run, a tributary of the Perkiomen near Audubon; Skippack Creek near Lower Providence; western tributary of the Perkiomen near Doe Run and another near Yerkes; Perkiomen at Yerkes; West Swamp Creek, a tributary of the Perkiomen at Zieglerville; Rich Valley Creek at Sumneytown; North East Branch of Perkiomen Creek.

Ameiurus nebulosus (Le Sueur). Yerkes and North East Branch of Perkiomen, also the next.

Schilbeodes insignis (Richardson).

Semotilus atromaculatus (Mitchill). Near Doe Run and at Yerkes.

Abramis crysoleucas (Mitchill). North East Branch of Perkiomen.

Notropis whipplii analostanus (Girard). Lower Providence, Yerkes, Zieglerville, Sumneytown and North East Branch of Perkiomen.

Notropis cornutus (Mitchill). Same as last, except not found at Zieglerville.

Notropis photogenis amœnus (Abbott). Three examples, 64 to 83 mm. in length, from Lower Providence. The smallest has a distorted vertebral column, so that its body in the vertical axis appears slightly sigmoid after the dorsal fin. The others are the largest examples I ever secured, and are spawning females, full of ova. Their depth is $4\frac{1}{2}$ to $4\frac{3}{4}$. They were obtained in a pool, possibly 30 inches deep, and are without brilliant coloration.

Rhinichthys atronasmus (Mitchill). Mine Run, near Doe Run and at Yerkes.

Cyprinus carpio Linné. Yerkes.

Catostomus commersonnii (Lacépède). Mine Run, Lower Providence, Yerkes and North East Branch of Perkiomen.

Erimyzon sucetta oblongus (Mitchill). Yerkes.

Anguilla rostrata (Le Sueur). Yerkes and North East Branch of Perkiomen.

Fundulus diaphanus (Le Sueur). North East Branch of Perkiomen.

Lepomis auritus (Linné). Yerkes, Zieglerville and North East Branch.

Pomotis gibbosus (Linné). Yerkes and North East Branch.

Micropterus dolomieu Lacépède. North East Branch.

Perca flavescens (Mitchill). Yerkes.

DELAWARE.

Nine collections were made by the writer, with Messrs. H. E. Thompson and L. Dorsey, in the lower part of the State: West Branch of the Nanticoke, and East Branch, 4 miles west of Harrington, October 3, 1920; headwaters of Brown's Branch, near Harrington, October 4; Cedar Creek south of Lincoln City, from the P. R. R. down its lower course and passing two mill-dams, October 4; Indian River at Millsboro, October 5; estuary of creek flowing from Dagsboro, near Indian River Bay, October 5; Ocean View, October 5; headwaters of Herring Creek, and lower fresh waters of same, October 6.

Brevoortia tyrannus (Latrobe). School of small ones in Indian River just below Millsboro.

Anchovia mitchilli (Valenciennes). Mouth of stream from Dagsboro.

Schilbeodes gyrinus (Mitchill). East and West Branches of Nanticoke.

Abramis crysoleucas (Mitchill). West Branch of Nanticoke, Cedar Creek at first dam, Millsboro and lower Herring Creek.

Notropis hudsonius amarus (Girard). West Branch of Nanticoke.

Notropis chalybæus (Cope). Cedar Creek at first and second dams, and lower Herring Creek.

Erimyzon sucetta oblongus (Mitchill). East Branch of Nanticoke.

Anguilla rostrata (Le Sueur). West Branch of Nanticoke and fresh pond at estuary of Herring Creek.

Esox americanus (Gmelin). West Branch of Nanticoke and Cedar Creek at upper dam.

Esox tridecemlineatus Mitchill. Cedar Creek at both dams, Millsboro and Herring Creek headwaters.

Umbra pygmæa (De Kay). West Branch of Nanticoke.

Fundulus majalis (Walbaum). Estuaries from Dagsboro and Herring Creek.

Fundulus heteroclitus macrolepidotus (Walbaum). Localities as for last species, and in ditch at Ocean View.

Fundulus diaphanus (Le Sueur). Fresh ponds along Herring Creek estuary.

Lucania parva (Baird). Ocean View and Herring Creek, also the next.

Cyprinodon variegatus Lacépède.

Gambusia affinis (Baird and Girard). Lower dam on Cedar Creek, Millsboro, Ocean View and Herring Creek. In ponds and often in fresh water.

Menidia beryllina (Cope). Stream from Dagsboro and lower Herring Creek.

Menidia menidia notata (Mitchill). Estuary from Dagsboro stream.

Apeltes quadracus (Mitchill). Millsboro.

Aphredoderus sayanus (Gilliams). West Branch of Nanticoke Creek. Brown's Branch, upper Cedar Creek and first dam.

Trachinotus carolinus (Linné). The only fish we found in the surf at Bethany Beach. Along the shores of Delaware Bay, at Slaughter

Beach, the following were reported recently or during the warm period in late September: *Mustelus canis*, *Raja eglanteria*, *Dasyatis say*, *Brevoortia tyrannus*, *Alosa sapidissima*, *Pomolobus pseudoharengus*, *Cynoscion regalis*, *Leiostomus xanthurus* and *Micropogon undulatus*. But one *Acipenser sturio*, reported taken at the fishery below, during the spring.

Acantharchus pomotis (Baird). We captured a single adult in the upper waters of Herring Creek. This is an interesting addition to the fauna of the State.

Enneacanthus gloriosus (Holbrook). East and West Branches of the Nanticoke, Cedar Creek at both dams and Herring Creek in fresh water.

Mesogonistius chætodon (Baird). Upper dam on Cedar Creek.

Lepomis auritus (Linné). West Branch of Nanticoke.

Pomotis gibbosus (Linné). With the last, also in Cedar Creek at the upper dam and in brackish water of stream from Dagsboro.

Boleosoma nigrum olmstedii (Storer). West Branch of Nanticoke and Brown's Branch.

Boleithys fusiformis (Girard). West Branch of Nanticoke and Cedar Creek at both dams.

Cynoscion nebulosus (Cuvier). Estuary from Dagsboro stream, also the next.

Pseudopleuronectes americanus (Walbaum).

MARYLAND.¹

Small collections were made in Barrow Creek, tributary to the Rhodes River, and Glebe Creek, a fresh tributary of the South River in Anne Arundel County, during May of 1920, with Mr. R. M. Abbott. In Cecil County Mr. H. L. Mather and the writer visited Elk Neck and Piney Creek Cove, on the Elk River, September 25, 1920. Two days later Stony Run and streams about North East and Charlestown were examined.

Ameiurus catus (Linné). Elk Neck.

Ameiurus nebulosus (Le Sueur). Glebe Creek.

Hybognathus nuchalis regius (Girard). Elk Neck and Piney Creek Cove.

Abramis crysoleucas (Mitchill). Glebe Creek, Stony Run and North East.

¹ The only Virginia fishes received recently are a number of *Fundulus heteroclitus macrolepidotus* from the Warwick River, from partly salt water. They were obtained by Dr. Henry Tucker, March 5, 1919.

- Notropis bifrenatus* (Cope). Piney Creek Cove.
Notropis hudsonius amarus (Girard). Elk Neck.
Notropis whipplei analostanus (Girard). Stony Run and second brook above Charlestown.
Notropis cornutus (Mitchill). Stony Run.
Ermyzon sucetta oblongus (Mitchill). Piney Creek Cove.
Anguilla rostrata (Le Sueur). Barrow Creek and North East.
Fundulus heteroclitus macrolepidotus (Walbaum). Barrow Creek.
Fundulus diaphanus (Le Sueur). Piney Creek Cove and North East, also the next.
Menidia beryllina (Cope).
Menidia menidia notata (Mitchill). Barrow Creek.
Apeltes quadracus (Mitchill). Piney Creek Cove.
Seserinus paru (Linné). One from the Rhodes River, obtained by Mr. Abbott, September 25, 1920.
Enneacanthus gloriosus (Holbrook). Piney Creek Cove.
Lepomis auritus (Linné). North East.
Pomotis gibbosus (Linné). Piney Creek Cove, Elk Neck and North East.
Perca flavescens (Mitchill). Elk Neck, second brook above Charlestown and North East.
Boleosoma nigrum olmstedii (Storer). Piney Creek Cove.
Roccus lineatus (Bloch). Elk Neck, North East, with next.
Morone americana (Gmelin).
Leiostomus xanthurus Lacépède. Barrow Creek.
Micropogon undulatus (Linné). Barrow Creek and Elk Neck.
Gobiosoma bosc (Lacépède). Barrow Creek.

SOUTH CAROLINA.

In May of 1917 Dr. Witmer Stone obtained an interesting small collection from the Pocataligo River, near Manning. He had previously visited this locality in 1914 and published a list of the fishes obtained then.² It is noteworthy that three of the species secured then are not represented in the present collection, though there are equally as many present not in the 1914 lot, and one appears new to science.

Notropis stonei new species. Head $3\frac{1}{2}$; depth 4; D. 11, 8; A. 11, 8; P. 1, 12; V. 1, 7; scales 30 in lateral line to caudal base and 3 more on latter; 7 scales above l. l. to dorsal origin, 3 below to anal

² Copeia, September 15, 1914. No. 10.

origin; predorsal scales 18, snout 4 in head; eye $3\frac{1}{2}$; maxillary $3\frac{1}{2}$; interorbital $2\frac{1}{2}$; second simple dorsal ray $1\frac{1}{2}$; second simple anal ray $1\frac{1}{2}$; pectoral $1\frac{1}{2}$; ventral $1\frac{1}{2}$; least depth of caudal peduncle $2\frac{1}{2}$; upper caudal lobe 1.

Body well compressed, edges rounded, deepest at dorsal origin. Caudal peduncle compressed, least depth $1\frac{1}{2}$ its length.

Head conic, moderately compressed, flattened sides moderately approximated below. Snout wide, conic, length $\frac{2}{3}$ its width. Eye large, advanced, hind pupil edge nearly midway in head length. Mouth moderate, oblique, jaws even. Maxillary largely concealed, reaches eye. Premaxillaries protractile. Jaw edges moderately trenchant. Lips narrow. Mandible rather shallow and rami little elevated inside mouth. Nostrils together, near last $\frac{2}{3}$ in snout. Interorbital broadly and evenly convex.

Gill-opening forward about opposite front pupil edge. Rakers small, weak, obsolete or scarcely evident. Filaments about half of eye. Isthmus narrow, especially forward, where frenum narrow. Pharyngeal teeth 5-4, well hooked, and broad grinding surfaces entire.

Scales large, well exposed, more or less uniform on trunk and smaller on caudal base, belly and breast. Scales cycloid; basal radiating striæ 9; circuli rather coarse, 16 to 20, weak and obsolete apically. Scales disposed in longitudinal rows parallel with l. l., which continuous to caudal base and well decurved forward; small tubes simple.

Dorsal origin about midway between hind eye edge and caudal base, second simple ray longest. Anal rather well developed, like dorsal, inserted little nearer caudal base than pectoral origin. Caudal moderate, emarginate behind. Pectoral moderate, not quite reaching ventral. Last inserted well before dorsal, reaches anal. Vent close before anal.

Color in alcohol faded dull brown, paler or whitish below. Dark lateral band begins at snout tip and extends to caudal base, and on sides forward expanded until much wider than eye. Fins all pale, ventral and anal slightly whitish. Dorsal with dusky blotch forward near base. Lateral dark band ends in dusky blotch at caudal base size of pupil, which reflected out on median caudal rays basally. Along back pale longitudinal line separates color from back above.

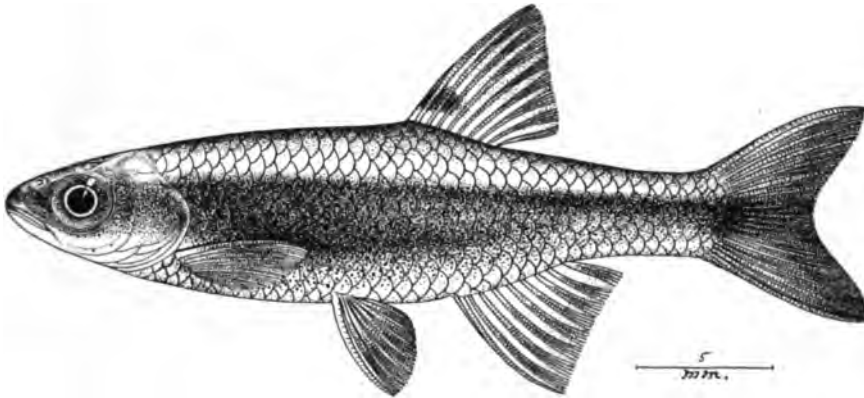
Length 36 mm.

Type, No. 50,118, A. N. S. P. Pocatigo River near Manning. May 1917. Dr. Witmer Stone.

Paratypes, Nos. 50,109 to 50,121, same data. Head $3\frac{1}{2}$ to $3\frac{1}{4}$; depth $4\frac{1}{2}$ to $4\frac{3}{4}$; D. II, 7 or 8; A. II, 8; scales 29 ? to 32 in lateral line to caudal base, and several more on latter; predorsal scales 15 or 16; snout $3\frac{1}{2}$ to $3\frac{1}{4}$ in head from upper jaw tip; eye $2\frac{1}{2}$ to 3; maxillary $2\frac{1}{2}$ to 3; interorbital 3 to $3\frac{1}{4}$; length 20 to 35 mm.

Of this species I have seen only the above examples. They apparently represent a species allied in the subgenus *Alburnops* as the pharyngeal teeth are uniserial and well hooked, lateral line complete, and large scales (less than 40) well exposed. *N. stonei* may readily be distinguished from the other lowland species of the genus, *N. roseus* and *N. chalybæus*, by its extremely broad dark lateral band and dark blotch on the dorsal fin.

(For Dr. Witmer Stone, who collected the types.)



Notropis stonei, new species.

Notropis chalybæus (Cope). Four examples.

Fundulus notti (Agassiz). Abundant.

Gambusia affinis (Baird and Girard). Very abundant, females more so and greatly larger than males. Largest female 58 mm.

Chænobryttus gulosus (Cuvier). Several.

Enneacanthus gloriosus (Holbrook). Five examples, all dull in color.

GEORGIA.

On March 25, 1904, Mr. J. A. G. Rehn secured a few fishes in a small stream at Thomasville.

Abramis crysoleucas bosci (Valenciennes). Fifteen examples.

Erimyzon sucetta (Lacépède). One.

Esox americanus (Gmelin). One.

Fundulus nottii (Agassiz). Four.

Lepomis megalotis (Rafinesque). Ten. Also one on March 30.

FLORIDA.

Mr. Morgan Hebard obtained a fine lot of small fishes from the Everglades about Miami in March, 1920. Mr. Howard R. Hill sent a number of specimens and notes, on the fishes noticed during the fall of 1920, in Pensacola Bay near Pensacola. These are all indicated by the letter P.

Scoliodon terræ-novæ (Richardson). P.

Dasyatis sabina (Le Sueur). Three young from Allenhurst, July, 1917. H. W. Aitken. These show the front margins of the disk slightly concave opposite the nostrils.

Elops saurus Linné. P.

Harengula pensacolæ Goode and Bean. Young from Useppa Island, Lee County, obtained by Mr. Hebard in 1919.

Brevoortia tyrannus patronus Goode. P.

Anchovia mitchilli Valenciennes. P.

Gymnothorax funebris Ranzani. P.

Fundulus similis (Baird and Girard). Two smaller ones from Useppa Island, Charlotte Harbor, in May, 1919, obtained by Mr. Hebard.

Fundulus grandis Baird and Girard. Abundant and all of moderate size and variable. In alcohol many males with orange caudal, ventral and anal borders. In other specimens these fins gray. Tamiami Canal, Everglades. March 8 to 12. 1920.

Fundulus confluentus Goode and Bean. Large series from the Tamiami Canal. The species is more abundant than the preceding, which it greatly resembles. It may be distinguished at a glance by at least one blackish or dusky vertical line, or bar, on the caudal basally, also the presence of a black blotch ocellated with white on the last dorsal rays, which occurs in both sexes. It is very variable, the back mostly finely spotted with black or dusky, which usually assumes a greatly mottled appearance. In one example approaching melanism the ground-color in alcohol is pale warm brown above, greatly specked or spotted with blackish, the spots completely covering dorsal and caudal fins and extending well down side. Dark lateral bars very variable in intensity, mostly distinct or pronounced

in males and young. Male also with pectoral, anal and caudal more or less gamboge.

Fundulus cingulatus Valenciennes. Four from the Tamiami Canal. Color in alcohol largely dull olivaceous, with rounded pale scattered pearly spots on side. Anal with 9 branched rays.

Jordanella floridae Goode and Bean. Abundant at Muck, Tamiami Canal. In alcohol back shows 4 to 6 dull-brown saddle-like blotches. Younger or smaller examples more contrasted, with 7 or 8 dull brown vertical bars, which may be interrupted above to form alternately with dark blotches along back. All show black median lateral blotch.

Mollienisia latipinna Le Sueur. Very abundant, at Muck, with the preceding.

Corythoichthys albirostris Kaup. One received from Mrs. George Eubank, through Mr. Clarence B. Moore, from Marco in Lee County, obtained in April, 1919.

Cypselurus heterurus (Rafinesque). Many young, about 40 in all, from Miami Beach, obtained by Mr. Hebard. Largest 50 mm., smallest 13. These show great variation. The pectoral reaches back nearly far as tip of depressed ventral. Of the specimens counted anal shows 10 branched rays. Lower part of sides usually with 5 large dusky blotches. Pectoral blackish. Dorsal dark, though in some small examples dusky, and anal white like caudal.

Strongylura notata (Poey). P.

Strongylura timucu (Walbaum). P.

Membras vagrans (Goode and Bean). Small example from near Useppa Island, in Lee County, May, 1920.

Menidia beryllina (Cope). Young with the last.

Mugil cephalus Linné. Two in the Querimana stage, from near Useppa Island. Both have A. II, 9, and are 22-23 mm. in length.

Sarda sarda (Bloch). P.

Scomberomorus maculatus (Mitchill). P.

Selar crumenophthalmus (Bloch). P.

Selene vomer (Linné). P.

Vomer setapinnis (Mitchill). P.

Trachinotus falcatus (Linné). One from Miami Beach. Length 15 mm. D. VII, 20; A. III, 18.

Seserinus paru (Linné). P.

Coryphaena hippurus Linné. Seven from Miami Beach, largest 50mm.

Gobiomorus gronovii (Gmelin). Six from Miami Beach.

Chaenobryttus gulosus (Cuvier). Abundant at Muck in the Tamiami Canal.

Lepomis punctatus (Valenciennes). Eight from the Tamiami Canal at Muck. All with long gill-rakers, and pectorals shorter than head. Spots variable.

Lepomis megalotis (Rafinesque). Very abundant with the last two. All small and quite variable in color. Many, especially larger, show a slightly darker spot on each scale basally, in alcohol. Most all show pale blue bars or lines on the snout, side of head and cheek. In none, though often wide, is the opercular flap produced. Many show dark fins. In all the rakers are short, rather weak and mostly less than 10. Pectoral always much less than head.

Lepomis incisor (Valenciennes). Four from the Tamiami Canal. Largely silvery when fresh in alcohol. No blue lines on side of head. Pectoral long as head and rakers lanceolate. Though small, these appear more slender than in the last species.

Epinephelus striatus (Bloch).² P.

Epinephelus morio (Valenciennes). P.

Garrupa nigrita (Holbrook). P.

Promicrops guttatus (Linné). During the winter of 1905 Capt. Willoughby secured a large adult example at Ft. Lauderdale, the skull of which is in the collection.

Mycteroperca falcata phenax Jordan and Swain. P.

Lutjanus aya (Bloch). P.

Lagodon rhomboides (Linné). P.

Cynoscion nothus (Holbrook). P.

Bairdiella chrysura (Lacépède). P.

Leiostomus xanthurus Lacépède. P.

Menticirrhus americanus (Linné). P.

Abudefduf marginatus (Bloch). Young example, 15 mm. long from Miami Beach.

Halichæres bivittatus (Bloch). P.

Akuttera schæpfii (Walbaum). P.

Chilomycterus schæpfii (Walbaum). Two from South Boca Grande in Boca Grande Pass. Collected by Mr. Hebard in May, 1920. These are exactly the reverse of Eigenmann's statement that "in the young there seems to be more lines than in the old. Two speci-

² Mr. Hebard secured an example of *Apogonichthys stellatus* Cope, 43 mm. long, at North Bimini Island, Bahamas, March 13, 1920.

mens examined, 3 inches long, have 17 lines between the pectorals; a specimen 5 inches long has 10 lines; and the largest specimen examined, 10 inches long, has 12 lines."⁴ My larger example, 155 mm. long, has 21 lines between the pectorals; the smaller example, 132 mm. long, has 10 lines between the pectorals. Their general color-pattern is similar, even to the disposition of the black blotches, though these are quite variable, likewise the armature. The fins are pale or whitish, and uniform in color.

Prionotus tribulus (Bloch). P.

Citharichthys macrops (Dresel). P.

Opsanus tau (Linné). Allenhurst. November 11, 1917. H. W. Aitken.

Gobiosox strumosus Cope. Small one from an empty shell at Captiva Pass, south end of Lacost Island. Obtained by Mr. Hebard in May, 1920.

Histrio histrio (Linné). Of 21 young from Miami Beach, largest 45 mm. These show great variation in color-pattern, and even the smaller ones may be coarsely or finely variegated.

ILLINOIS.

With two exceptions, as noted, the following were secured by Mr. W. T. Innes in a small tributary of the Illinois River at Marley, in September 1, 1912.

Campostoma anomalum (Rafinesque).

Chrosomus erythrogaster (Rafinesque).

Notropis cornutus (Mitchill).

Notropis atherinoides Rafinesque. Mr. C. J. Hunt⁵ sent eight examples from the West Fork of the South Branch of the Chicago River, January 24, 1911.

Fundulus notatus (Rafinesque).

Micropterus dolomieu Lacépède.

Percina caprodes (Rafinesque). Two obtained by Mr. Innes from Fox Lake in October, 1920.

Boleosoma nigrum (Rafinesque).

Pæclichthys cæruleus (Storer).

Pæclichthys flabellaris (Rafinesque).

Cottus bairdii Girard.

⁴ Ann. N. Y. Acad. Sci., 3, 1883-5 (1885), p. 308.

⁵ Also several examples of *Semotilus atromaculatus* and *Perca flavescens* from Wawasee, Indiana, obtained July 12, 1913.

WISCONSIN.

Mr. H. T. Wolf obtained the following in Booth's fish market, Milwaukee, during the summer of 1906:

Coregonus quadrilateralis Richardson. Lake Superior.

Coregonus clupeaformis (Mitchill). Lakes Superior and Michigan, and Georgian Bay.

Leucichthys nigripinnis (Milner). Milwaukee.

Leucichthys prognathus (H. M. Smith). Milwaukee.

Salvelinus fontinalis (Mitchill). Lakes Superior and Michigan.

Cristivomer namaycush (Walbaum). Milwaukee.

Micropterus salmoides (Lacépède). Fox Lake.

Stizostedion vitreum (Mitchill). Milwaukee, also next two.

Stizostedion canadense (Griffiths).

Perca flavescens (Mitchill).

MINNESOTA.

Mr. F. L. Tappan secured the following about Minneapolis during September 1911:

Semotilus atromaculatus (Mitchill).

Notropis heterodon (Cope).

Notropis cornutus (Mitchill).

Schilbeodes gyrimus (Mitchill).

Umbra limi (Kirtland). Cedar Lake.

Labidesthes sicculus (Cope).

Eucalia inconstans (Kirtland).

Pomoxis sparoides (Lacépède).

Lepomis megalotis (Rafinesque).

Boleosoma nigrum (Rafinesque).

MISSOURI.

Mr. Julius Hurter sent a small collection in July, 1912, from Fox Creek, a tributary of the Meramec River, at a point about 26 miles from St. Louis:

Ichthyomyzon concolor (Kirtland). Adult.

Scaphirhynchus platyrhynchus (Rafinesque). Young example.

Polyodon spathula (Walbaum). Young.

Lepisosteus platostomus (Rafinesque). Young.

Amiatus calvus (Linné). Small example.

Campostoma anomalum (Rafinesque). One from St. Louis in fall of 1915.

Chrosomus erythrogaster (Rafinesque). Several.

Pimephales notatus (Rafinesque). One from St. Louis received from Mr. W. T. Innes in 1918.

Notropis cornutus (Mitchill). Adult.

Notropis zonatus (Agassiz). Two.

Lepomis humilis (Girard). One from St. Louis. Obtained from Mr. Innes, November 1, 1920.

Pæcilichthys cæruleus (Storer). Several.

Cottus bairdii Girard. Several.

ARIZONA.*

Several species were secured by Dr. Henry A. Pilsbry in the fall of 1910 for the Academy.

Campostoma anomalum (Rafinesque). Dr. Witmer Stone obtained 6 young examples in a stream in Rucker Canyon, headwaters of the Rio Yaqui basin, at 6500 feet elevation in the Chiricahua Mountains, July 8, 1919.

Leuciscus intermedius (Girard). Very many from the Santa Cruz River at Tuecon, September 4, 1910, and a single example from the Salt River, tributary of the Gila at Tempe, September 5, 1910. Some of the larger examples tuberculated. These and the next all in Dr. Pilsbry's collections in the Academy.

Cyprinodon macularius Baird and Girard. One from the Salt River at Tempe.

Mollienisia occidentalis (Baird and Girard). Many with the last and from the Santa Cruz River at Tuecon.

UTAH.

The following were collected by Mr. Herbert J. Pack, of Logan, during the past season.

Leuciscus lineatus (Girard). Very many small ones from Hanyton Bridge, Bear River at Fielding, August 15. These all show but a short lateral line, not extending beyond the dorsal in the largest. Abundant in warm spring at Udy's Springs, Riverside, in Boulder County, August 12.

The largest example, from Magna, measures 100 mm. It and many young from slightly muddy fresh water, July 31.

Leuciscus phlegethontis (Cope). Two from meadow-streams in western part of Logan, August 9. Length 31 to 42 mm. Color of

* Mr. S. N. Rhoads obtained the following in the fresh waters of the Colorado River delta, in the vicinity of the Hardy River, Mexico, in the early spring of 1905; *Ameiurus nebulosus*, *Xyrauchen texanus*, *Gila elegans*, *Cyprinus carpio* and *Mugil cephalus*.

larger example, when fresh in alcohol, with median dusky lateral band from snout, including mandible tip, to caudal base. This band very distinct and composed of rather large dots. Parallel from upper eye edge back to caudal peduncle and defining color of back, narrower similar band or line, mostly pale posteriorly. From pectoral axil side of body below broad dark lateral band pale cadmium to anal base, and more yellowish on lower surface of caudal peduncle. Axils of pectoral and ventral more or less tinged with pale citron-yellow, also basal portions of paired fins. Breast, belly and lower surface of head, white. Dorsal and caudal dull olive, other fins pale, with dusky terminal tints.

Also two from small pond at edge of railroad, Salt Lake City, August 31.

Agosia nubila carringtoni (Cope). Abundant in meadow streams in western Logan, August 9. Most with lateral line incomplete and barbel absent.

Cyprinus carpio Linné. One from Hanyton Bridge.

Cottus semiscaber (Cope). Abundant, in meadow streams in western Logan, August 9. Largest 58 mm.

NEVADA.

Agosia nevadensis (Gilbert). Twelve examples, largest 55 mm. long, from the Amargosa River at Beatty, August 12, 1919. Obtained by Messrs. J. A. G. Rehn and Morgan Hebard. These fish were found in small schools, in the larger pools, and moderately plentiful.

CALIFORNIA.

During the late fall of 1897 the Academy received from Prof. Harold Heath a collection of fishes from Pacific Grove, all of which are still in good condition. These are indicated by the letter P. I have also included several notes given by Mr. J. A. G. Rehn on some of the larger fishes seen by him at Santa Catalina in the summer of 1907.

Polistotrema stouti (Lockington). P.

Galeorhinus zyopterus Jordan and Gilbert. Four small gray sharks at Santa Catalina, about 3 to 5 feet long, were evidently this species.

Raja binoculata Girard. P.

Torpedo californica Ayres. P.

Hydrolagus colliciei (Lay and Bennett). P.

Pogonichthys microlepidotus (Girard). Mr. F. S. Curtis forwarded an example of this and the following two species from Arroyo Crista Blanca at Livermore, which were received in September, 1912. He says, "in the winter and early spring this stream flows into the Bay of San Francisco, but in the summer is only a series of pools. The head of the stream is coarse gravel, several feet deep, and the water flows under ground between the deep pools. None of the pools are more than four feet deep, or usually only about two. The fish were caught in strong sulphur water, as just above the pool a strong sulphur-spring boiled up in the middle of the creek. This is so strong that it fills the air with the odor, and the stones, etc., in the pool are all coated with sulphur. About a dozen sculpins [*Cottus gulosus* (Girard)] $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long were caught, and were smooth. Those taken last year at Niles were prickly, with the sides rough. Together with the suckers [*Catostomus occidentalis* Ayres] and Sacramento perch [*Archoplites interruptus* (Girard)] they are about the only fish found here. The game-wardens are glad to have us take the dace as they are very destructive to the trout eggs and fry, and in fact the chief enemies they have in these streams."

Ptychocheilus grandis (Ayres).

Myloleucus symmetricus (Baird and Girard).

Atherinopsis californiensis Girard.

Cypselurus californicus (Cooper). Popular bait for tuna at Santa Catalina. Retailed for 10 cents each, or prices varied with abundance. Messrs Rehn and Hebard kindly furnished the note on this species and the following six.

Auxis thazard (Lacépède). Reported occasionally at Santa Catalina. One seen by Mr. Rehn $4\frac{1}{2}$ feet long a mounted dry specimen. Called "Japanese tuna" and "short-finned tuna."

Thunnus thynnus (Linné). Four seen at Santa Catalina and a number of mounted examples. Previously, or ten days before Mr. Rehn's stay, 15 to 20 were taken, and many more were reported since. Some were upwards of 168 lbs., and one of such size had a large piece bitten out by a shark. The examples Mr. Rehn saw ranged from 110 to 125 lbs. They were captured altogether by rod and reel anglers, with flying-fish as bait.

Germo alatunga (Gmelin). Called "albacore" and "long-finned tuna." Abundant game fish at Santa Catalina. Mr. Rehn took two of 18 lbs., one of 20 lbs and one of 27 lbs. The species attains a weight of 50 lbs.

Seriola dorsalis (Gill). "Yellow tail." Several fresh ones seen at Santa Catalina. Taken closer in shore than the other fishes.

Tetrapturus mitsukurii Jordan and Snyder. One example, captured September 21, 1910, about five miles off the southeastern shore of Santa Catalina, measured nine feet in length. At the time the species was irregular, or only a few taken by the anglers. They break at the surface, but do not jump like the tarpon. They do not strike the hook but take it gradually, so that after a short interval the angler sets it with a jerk. Then a battle ensues for half an hour or more, in which time the fish becomes exhausted and is finally gaffed. Mr. Rehn did not hear the alleged name "marlin spike-fish" for it at Santa Catalina.

Stereolepis gigas (Ayres). "Jew fish." Mr. Rehn reports 6 or 8 large ones on the dock at Santa Catalina, and the largest 6 or 7 feet long.

Genyonemus lineatus (Ayres). This and all the following from Pacific Grove: *Zalemnius rosaceus* (Jordan and Gilbert), *Cymatogaster aggregatus* Gibbons, *Oxyjulis californicus* (Günther), *Sebastodes paucispinus* (Ayres), *Sebastodes elongatus* (Ayres), *Anoplopoma fimbria* (Pallas), *Scorpaenichthys marmoratus* (Ayres), *Hemilepidotus jordani* Bean, *Taranichthys filamentosus* (Gilbert), *Eopsetta jordani* (Lockington), *Parophrys vetulus* Girard, *Microstomus pacificus* (Lockington), *Glyptocephalus zachirus* Lockington, *Citharichthys sordidus* (Girard), *Caularchus neandricus* (Girard), *Gibbonsia evdes* (Jordan and Gilbert), *Anoplarchus atropurpureus* (Kittlitz), *Xiphidion rupestre* (Jordan and Gilbert), *Anarrichthys ocellatus* Ayres, *Chilara taylora* (Girard), *Porichthys notatus* Girard.

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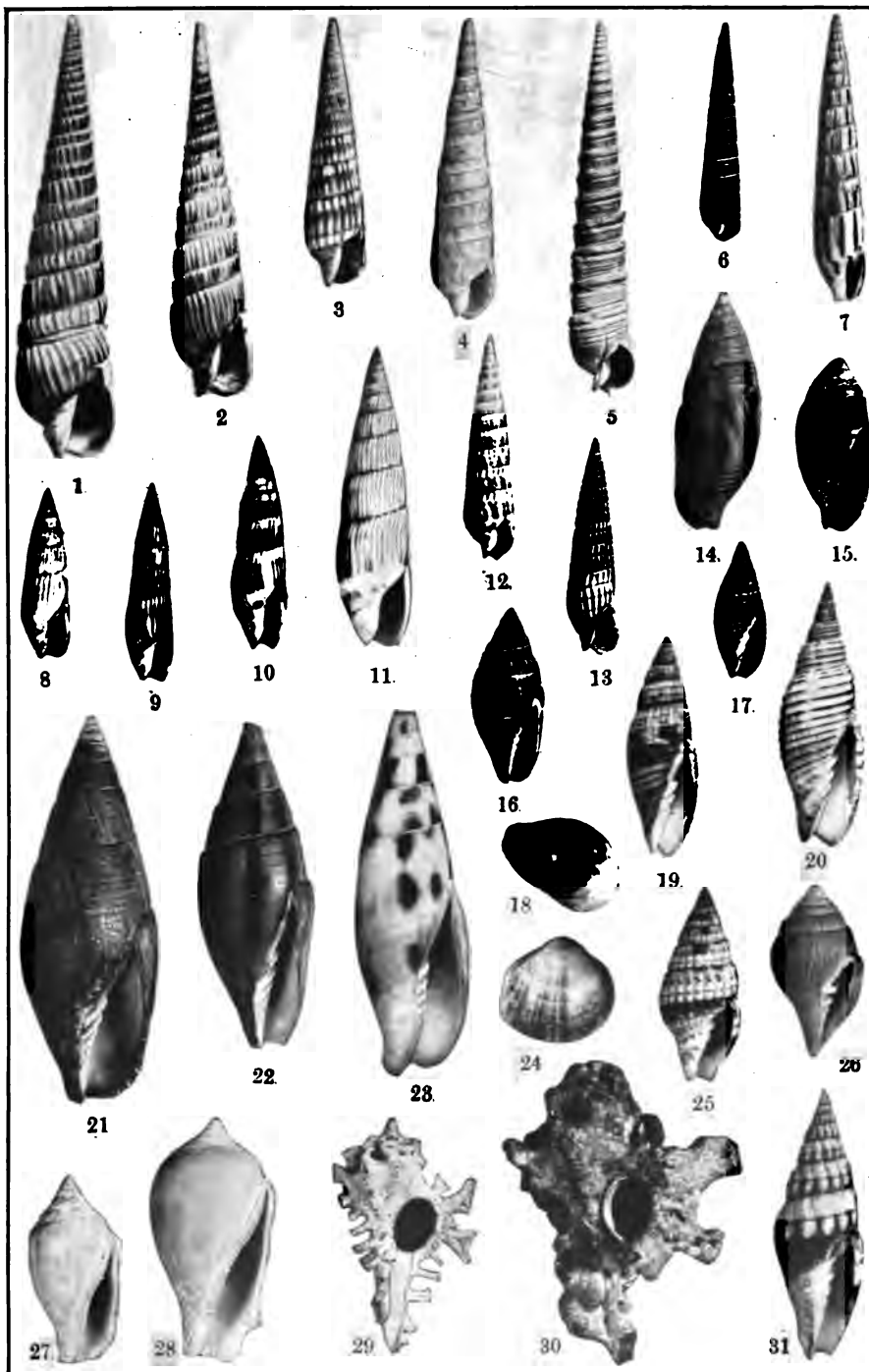
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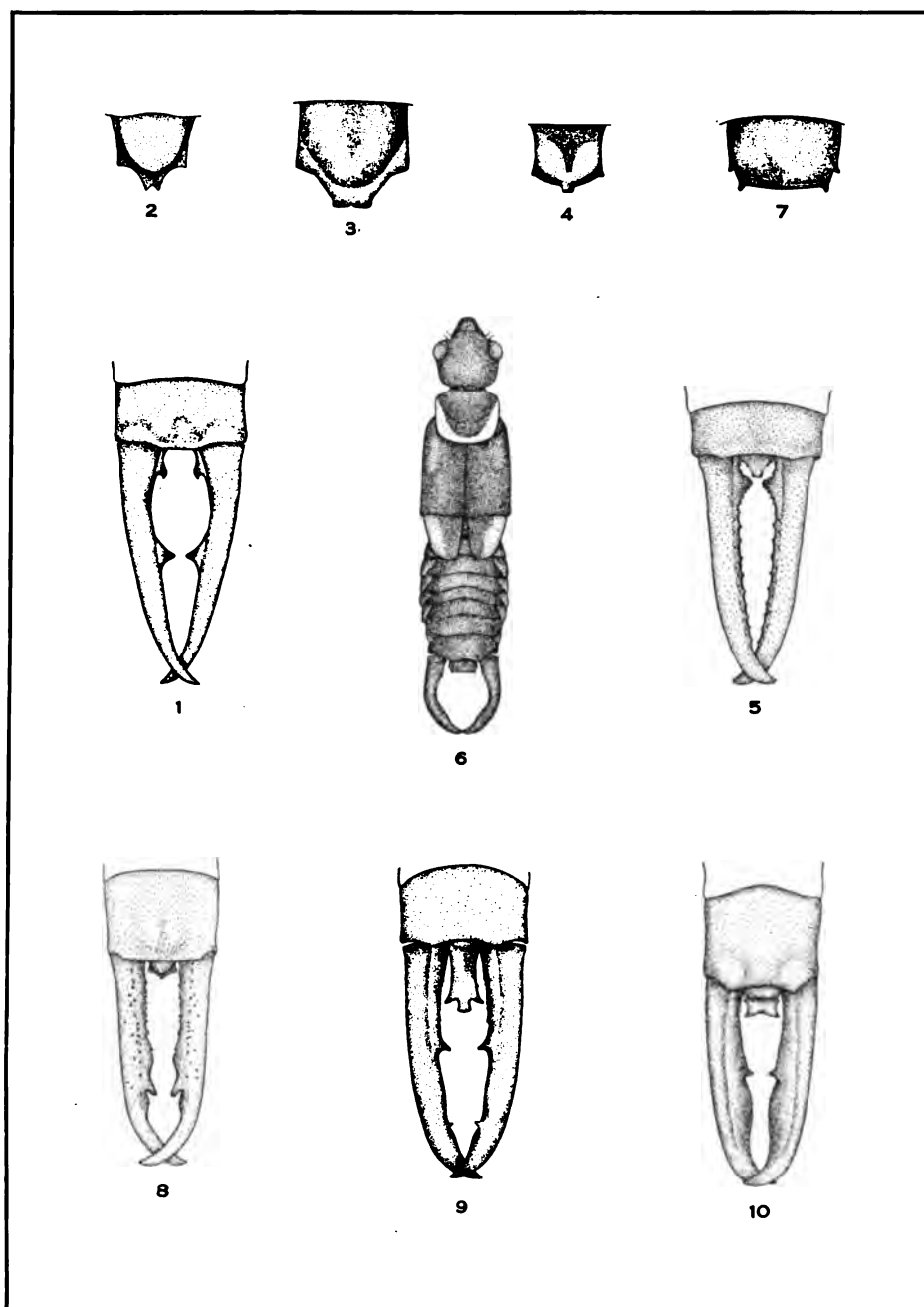
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